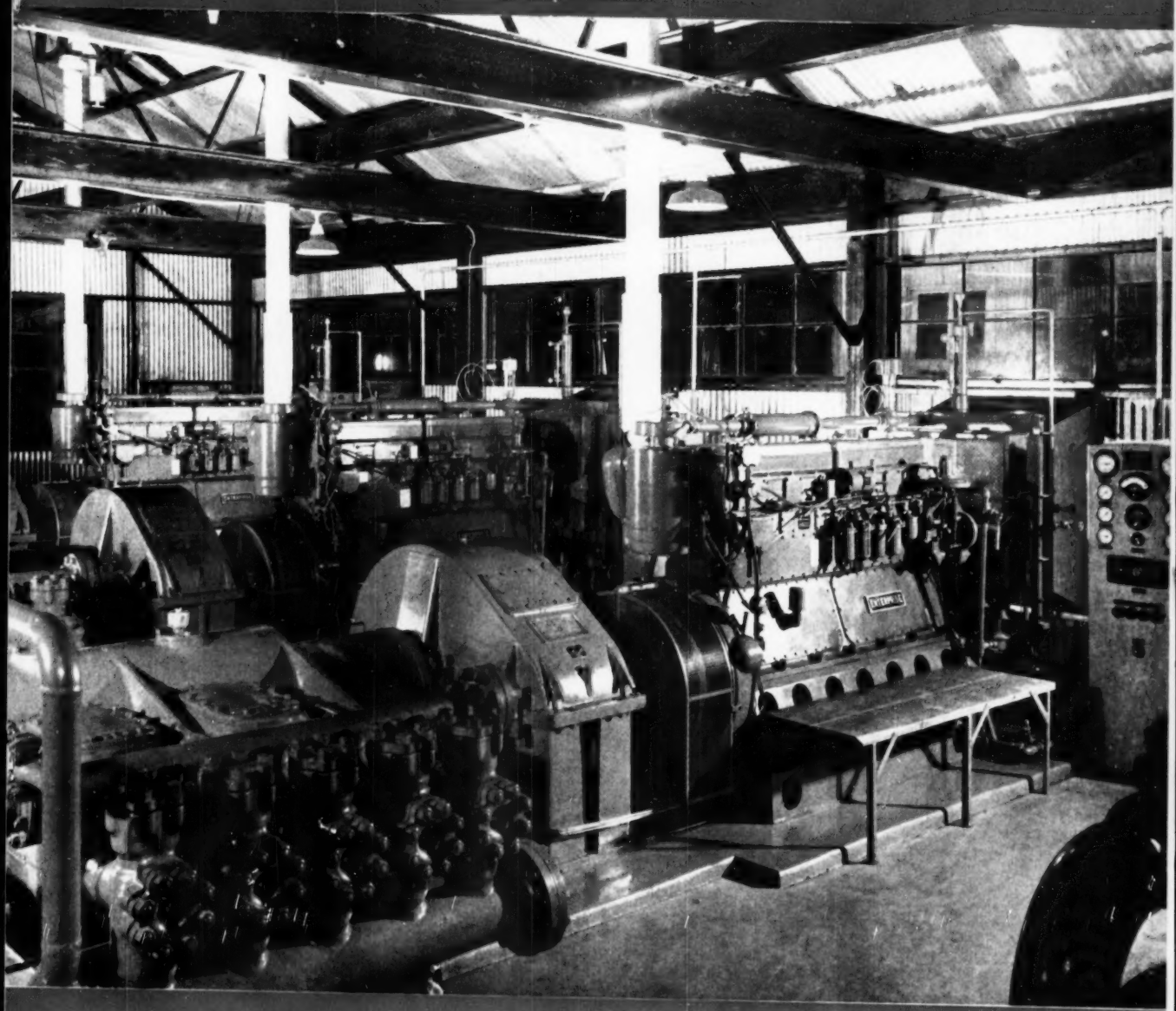
Diesel Power

& Diesel Transportation



Our 29th Year

The Steel Industry Needs Scrap— *Keep it Moving*

SEPTEMBER, 1951

YOU GET MORE POWER WITH LESS

TEXACO

TEXACO

DIESEL POWER and DIESEL TRANSPORTATION for September, 1951, Vol. XXIX, No. 9. It is published monthly by Diesel Publications, Inc., Orange, Conn. Executive and Editorial offices at 192 Lexington Ave., New York 16, N. Y. Subscription rates: United States, $3.00 per year, single copies 35¢; Canada $4.00; Foreign $5.00 per year. Entered as second class matter April 29, 1949 at the Post Office, Orange, Connecticut under Act of March 3, 1879.

FUEL...

...so COSTS COME DOWN when you use Texaco Ursa Oil

Whether you're using Diesel, gas or dual-fuel engines, you'll get better compression and combustion—with resulting lower fuel consumption—by lubricating with *Texaco Ursa Oil.* That's because rings stay free, ports stay clear, valves function properly.

Texaco Ursa Oil gives you these benefits because its high oxidation-resistance keeps engines clean. Harmful sludge and carbon won't build up. Wear is kept to the very minimum. Bearings are protected against corrosion. Parts last longer; maintenance costs are less.

You can get a *Texaco Ursa Oil* that's exactly right for your engines. There is a complete line, approved by leading engine builders, and they're America's No. 1 favorites. For example—

> More stationary Diesel h.p. and more railroad Diesel locomotives in the U. S. are lubricated with Texaco than with any other brand.

Bring *your* costs down with Texaco. A Texaco Lubrication Engineer will gladly help you. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd St., New York 17, N. Y.

URSA OILS FOR ALL DIESEL, GAS AND DUAL-FUEL ENGINES

International Harvester Company Model UD24 Portable Diesel Units . . . Power-Protected by Purolator

It aint smog, mister...

No, it isn't. *It's clouds of abrasive rock particles* from crushers and conveyors. Sudden death for unprotected engines!

Situations like this are good reason why so many manufacturers and operators rely on the Purolator* Micronic Oil Filter.

Purolator traps abrasive particles as small as microns (.000039"); traps more dirt faster—because it has a revolutionary accordion-pleated refill providing a filtering area up to 10 times greater than old-style filters. In addition, it won't warp, distort, or disintegrate.

For lube oil, the Purolator Micronic* assures less wear on hard-working bearings and other vital parts.

For fuel oil, it provides the complete filtration, so essential for close tolerance injector orifices.

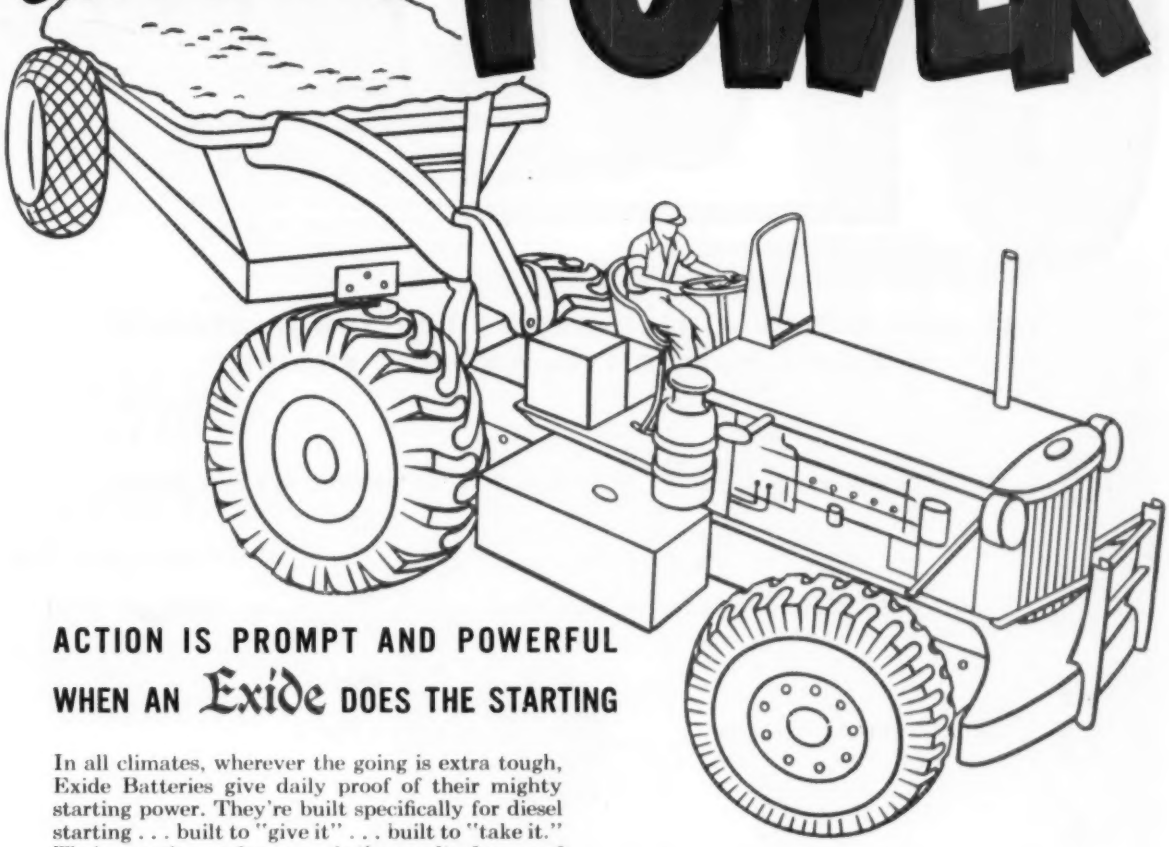
Whatever your filtering problem, let our engineering staff show you how to solve it! *Reg. U. S. Pat. Off.

Protect your Power with...

PUROLATOR PRODUCTS, INC.
Rahway, New Jersey and Toronto, Ontario, Canada
Factory branch offices: Chicago, Detroit, Los Angeles

PUROLATOR
MICRONIC OIL FILTER
"FIRST IN THE FIELD OF FILTERING"

STARTING POWER



ACTION IS PROMPT AND POWERFUL WHEN AN Exide DOES THE STARTING

In all climates, wherever the going is extra tough, Exide Batteries give daily proof of their mighty starting power. They're built specifically for diesel starting . . . built to "give it" . . . built to "take it." Their superior performance is the result of years of research-engineering, plus continuous testing under all service conditions. The object: to give you a battery that's outstanding for all heavy-duty starting jobs. In Exide diesel-starting batteries you get:

QUICK BREAKAWAY and fast acceleration of engine to firing speed.

LOW DEPRECIATION due to their extra long life.

LOW COSTS of operation and maintenance.

RUGGED CONSTRUCTION for rough usage in hard service.

Use Exide Diesel Starting Batteries for all heavy-duty service—in buses, trucks, tractors, off-the-highway equipment, ships, power plants, diesel-electric locomotives.

THE ELECTRIC STORAGE BATTERY COMPANY
Philadelphia 2

Exide Batteries of Canada, Limited, Toronto

"Exide" Reg. Trade-mark U.S. Pat. Off.

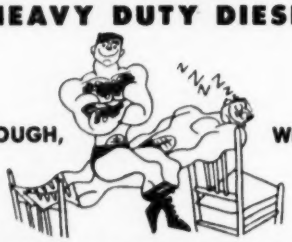
WHEN IT'S AN EXIDE YOUR DIESELS START

1888 . . . DEPENDABLE BATTERIES FOR 63 YEARS . . . 1951

CYCLAN

THE NEW PISTON RING MATERIAL FOR TOUGH SERVICE IN HEAVY DUTY DIESEL AND GAS ENGINES

1 *Cyclan* **IS TOUGH,**



WITH PLENTY OF TENSION, BUT NOT BRITTLE

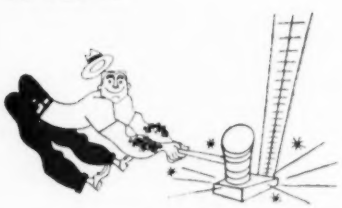
2 *Cyclan* **HAS TWICE THE BREAKAGE RESISTANCE**

OF ORDINARY IRON

3 *Cyclan* **RETAINS TENSION**

UP TO 700° F.

4 *Cyclan* **WITHSTANDS IMPACT, HAMMERING, FLEXING**



5 *Cyclan* **WITHSTANDS**

CONSIDERABLE DISTORTION WITHOUT LOSING SHAPE

6 *Cyclan* **RESISTS WEAR FAR BETTER**

THAN STANDARD RING IRON

AVAILABLE FOR RINGS UP TO 9" DIAMETER.

Write for complete information

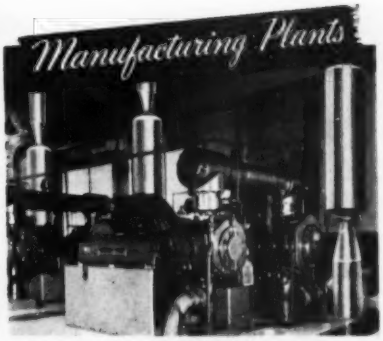
SEALED POWER CORPORATION
MUSKEGON, MICHIGAN

Sealed Power

PISTON RINGS · PISTONS
CYLINDER SLEEVES

Burgess-Manning Snubbers on gas booster engines at a Louisiana station.

Two Burgess-Manning Exhaust Snubbers installed on this yacht.



Burgess-Manning Snubbers on compressors at a manufacturing plant.

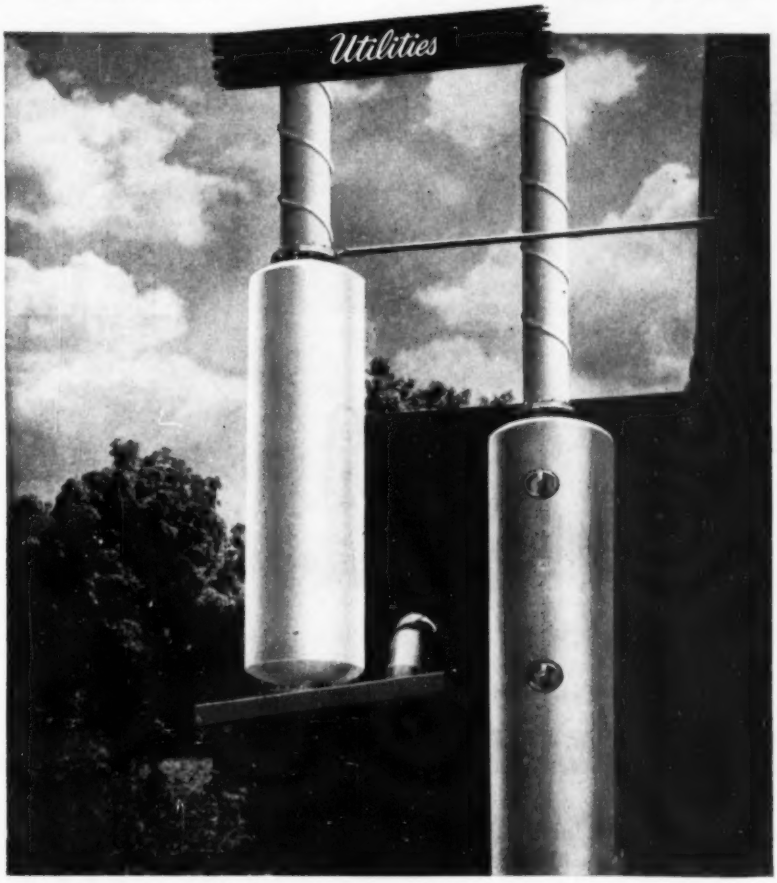
Reduce Noise

on Engine Exhausts and Compressor Intakes with

BURGESS-MANNING SNUBBERS

●

Build Good Will in Plant and Community—
Provide Quiet Surroundings...
with Burgess-Manning Snubbers



Burgess-Manning Snubbers installed at a Michigan diesel electric power plant.

● Wherever you find an internal combustion engine, compressor, blower, or pump, you will more than likely find a Burgess-Manning Snubber reducing noise . . . building good will for you in your plant and in your community. Burgess-Manning Snubbers smooth the flow of exhaust gases and intake air. High energy "slugs" of exhaust gas are dissipated in successive snubbing stages—the gas reaches the atmosphere in a smooth stream. Incoming pulses of turbulent air to compressors are likewise smoothed to a unidirectional flow. Noise is reduced, vibration is practically eliminated. Metering simplified. Performance of equipment stepped up. Reduce maintenance on engines, compressors, and associated equipment.

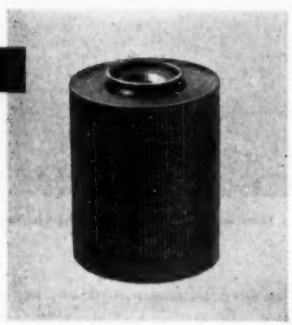
For an outstanding solution to your internal combustion engine or compressor noise problem, call in Burgess-Manning engineers, specialists in noise reduction and surge control problems.

BURGESS-MANNING COMPANY **LIBERTYVILLE, ILLINOIS**

AC OIL FILTERS

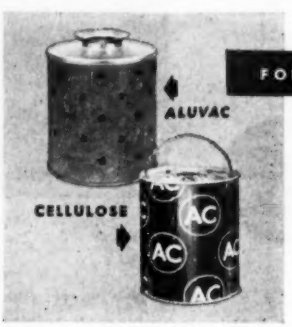
Protection PLUS *for Diesels*

FOR FUEL FILTERS



As protection for fuel injectors and transfer pumps, AC Elements are unequaled. They are engineered for factory-equipment Diesel fuel filters—and are precision-built to AC's highest quality standards. These AC Elements have been proved by millions of hours of service. Your engines need this *plus* protection to assure reliable operations.

FOR LUBE OIL FILTERS

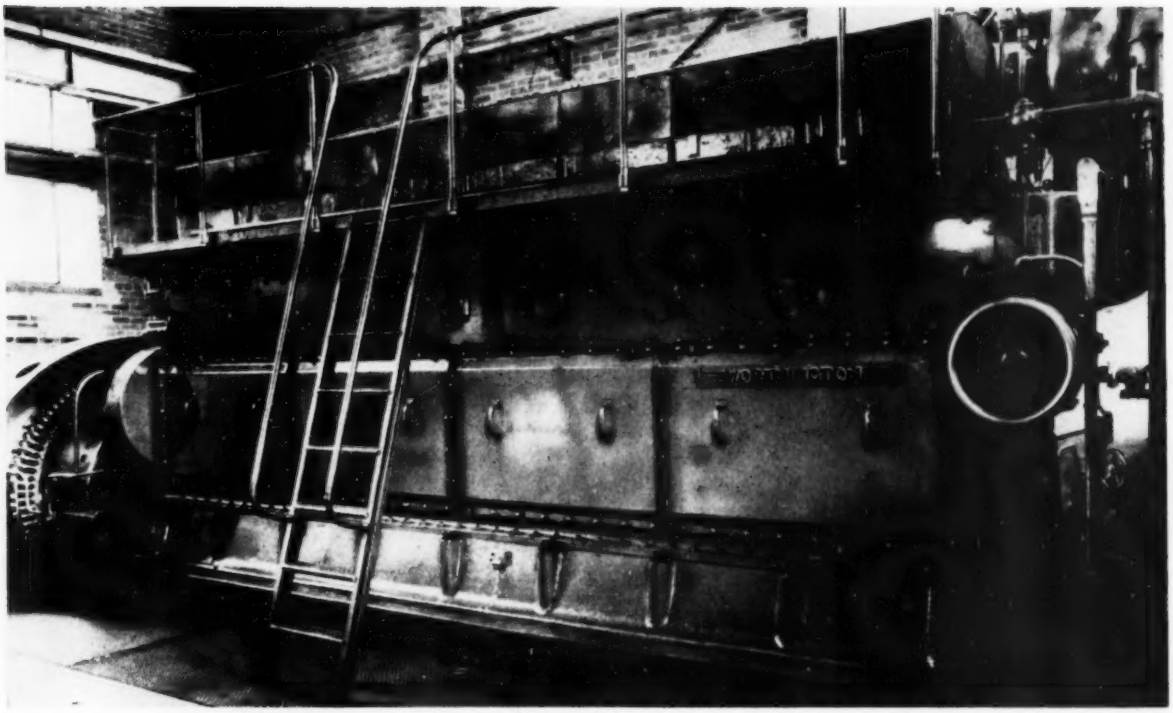


AC Lubricating Oil Filters and Elements are standard equipment on GMC Truck and Coach, Flexible Bus and Detroit Diesel engines.

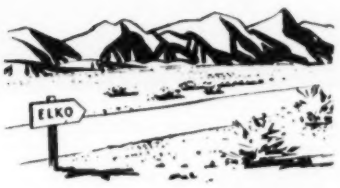
Replacement elements are available for nearly every make of lubricating oil filter—some made of cellulose and some of AC's new *Aluvac* filtering material. Either type gives your engines protection *plus*.

AC SPARK PLUG DIVISION • GENERAL MOTORS CORPORATION

"ONLY *CLEAN* OIL IS *SAFE* OIL!"



Worthington 8-cylinder 4-cycle turbo-charged Diesel engine—one of the two operated by Elko-Lamoille Power Company. This 1000 Kw-rated engine was installed on the same foundation originally built for an engine with 250-Kw rating.



Lesson in Cost Reduction

FROM THE MIDDLE OF THE DESERT

If you've never heard of Elko, you'll find this story interesting.

Elko is the seat of a county in Nevada that, all by itself, is larger than Massachusetts, Connecticut and Rhode Island together, with Delaware thrown in. Since pioneer days, it has been a transportation and trading center.

Elko's present power plant set-up, which includes two four-cycle turbo-charged Worthington Diesel engines connected to 1000-Kw generators, contrasts with the single 50-hp steam engine purchased second-hand in 1896 from a nearby silver mine.

Cost of power has never been more reasonable. Ever since 1940 when fuel oil cost this plant less than half what it does now, power rates have *gone down*—having been reduced twice during the period. Today, 87% of the power is produced by the two Worthington units, and in 1950 the plant averaged 13.3 Kw-hrs per gallon of fuel.

Lubricating oil consumption is low, too—well below the estimated 4,000 rated horsepower hours per gallon.

Want more evidence that there's *more worth in Worthington?* Write Worthington Pump and Machinery Corporation, Engine Division, Buffalo, N. Y.

WORTHINGTON

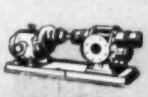
E.1.11

ECONOMICAL CONTINUOUS POWER

Diesel Engines, 150 to 2640 hp
Gas Engines, 190 to 2880 hp
Dual Fuel Engines, 345 to 2640 hp

WORTHINGTON-BUILT AUXILIARIES

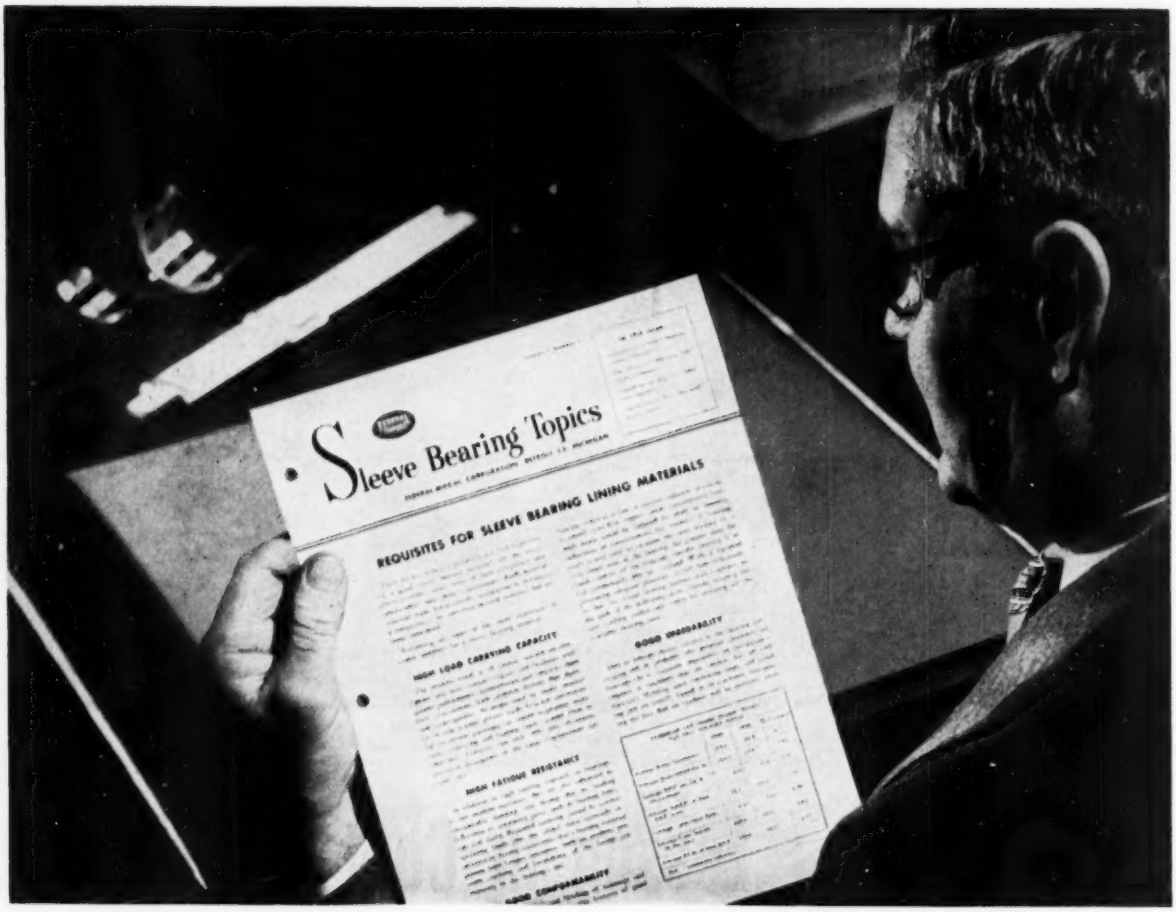
Balanced Angle Compressors



Oil Transfer Pumps

Cooling Water Circulating Pumps

Evaporative Type Engine Water Coolers



Send for these...

ENGINEERING BULLETINS on SLEEVE BEARING DEVELOPMENTS!

Here's a quick, convenient way for the designer, engineer and draftsman to keep up-to-date on developments in materials, design and applications of sleeve bearings, bushings and similar precision parts. The latest news on improved cast and sintered copper-leads . . . the new bi-metal rolled, split-type bearings . . . the re-design problems involved when shortages call for bearing lining changes . . .

"Sleeve Bearing Topics" will help keep you abreast of all of these developments. A request on your business letterhead places your name on the list. Right now we can also send you back issues to make your file complete. Fits standard files, punched for a 3-ring binder. Address your request to:

FEDERAL-MOGUL CORPORATION
11041 SHOEMAKER • DETROIT 13, MICH.

YOUR BUSINESS LETTERHEAD REQUEST brings all back issues while still available — but write now!

FEDERAL-MOGUL

Since 1899

Our six plants produce sleeve bearings in all designs and sizes; cast bronze bushings; rolled split-type bushings; bi-metallic rolled bushings; washers; spacer tubes; precision bronze parts and bronze bars.

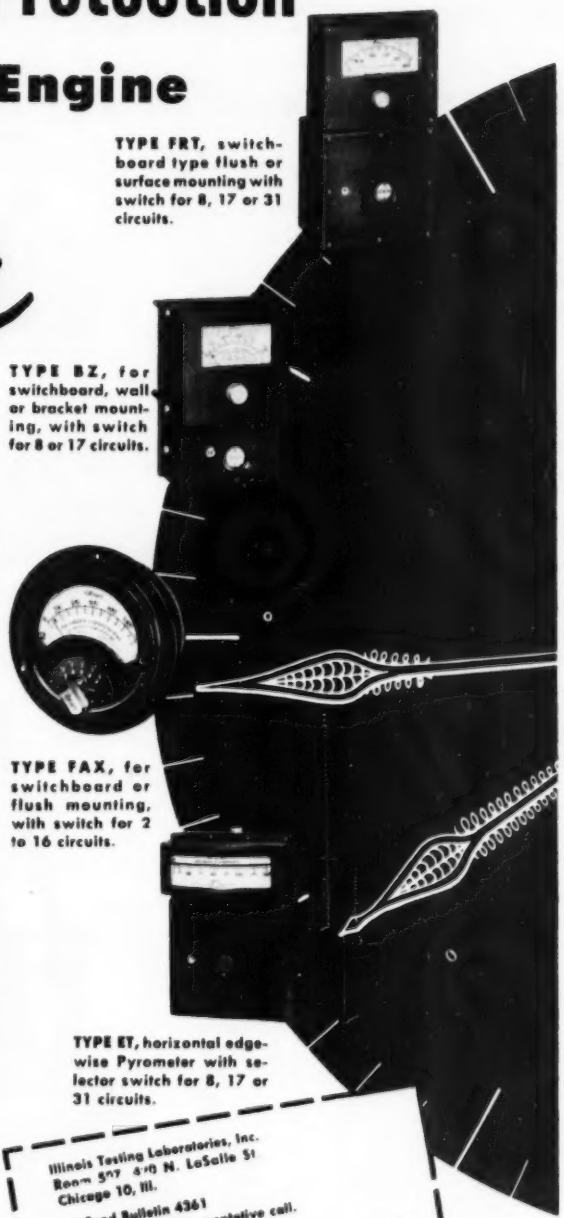
Round-the-Clock Protection

for your Diesel Engine

with

Alnor

PRECISION PYROMETERS



TYPE FRT, switchboard type flush or surface mounting with switch for 8, 17 or 31 circuits.

TYPE BZ, for switchboard, wall or bracket mounting, with switch for 8 or 17 circuits.

TYPE FAX, for switchboard or flush mounting, with switch for 2 to 16 circuits.

TYPE ET, horizontal edgewise Pyrometer with selector switch for 8, 17 or 31 circuits.

Every day that brings more material shortages makes your present diesel more valuable. Parts may soon be hard to get, and breakdowns will be more costly. Under such conditions, your diesel should have the ultimate in protection. Alnor precision-built pyrometers bring you round-the-clock protection . . . assure first-rate engine performance . . . first-rate profits.

Alnor pyrometers give an instant check on individual exhaust temperatures, anticipate trouble from pre-ignition, detonation, overloading or breakdown of lubrication. Such continuous protection reduces maintenance time and expense to a minimum—increases efficiency and operating economy. That's the type of protection so many diesel manufacturers are seeking when they specify Alnor pyrometers as original equipment.

Ask your Alnor representative *now* about these rugged, low-cost instruments. He'll be glad to help you choose the type of Alnor pyrometer and thermocouple exactly suited to your requirements. In the meantime, send for bulletin 4361, describing the complete pyrometer line—use this handy coupon.

Alnor

PRECISION INSTRUMENTS FOR EVERY INDUSTRY

Illinois Testing Laboratories, Inc.
Room 5[illegible] 420 N. LaSalle St
Chicago 10, Ill.

( ) Send Bulletin 4361
( ) Have Alnor Representative call.

Name.....
Company.....
Address.....State.....
City.....

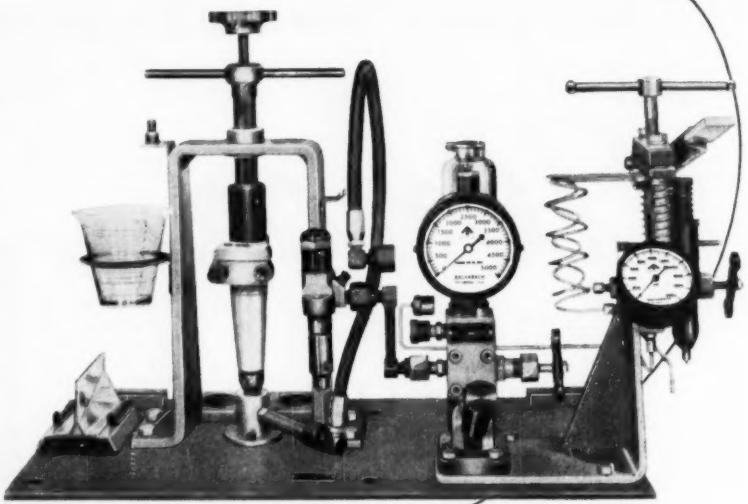
THE MOST COMPLETE LINE of Diesel Nozzle Testing Equipment EVER OFFERED!

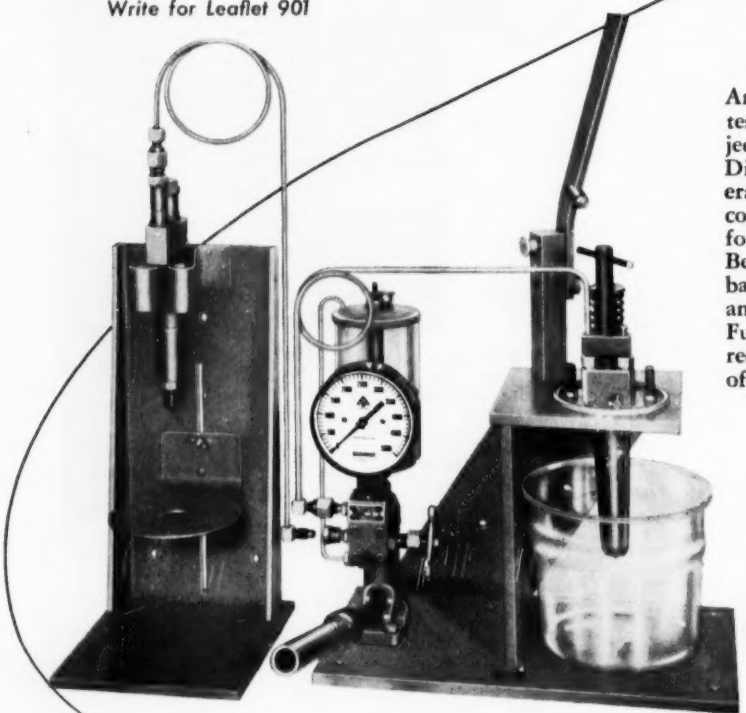
For AUTOMOTIVE DIESELS

A completely self-contained, easy-to-use and compact test set for checking nozzles and injectors of all Diesels up to 60 hp per cylinder. The heart of this test set is the Bacharach Nozzle Test Pump located in the center. Nozzles made by American Bosch, Bendix, Caterpillar, International Harvester, etc. are attached directly to test pump by means of steel tube and union nuts. Cummins injectors are held in test fixture at left; GM 71 injectors in test fixture at right. These fixtures have individual fuel pressure lines which may be interchangeably connected to test pump.

Test Set includes Connector Set 44 comprising connector tube, Ermeto adapter and fuel inlet connecting nuts for all American Bosch R, S and T size nozzles and similar size nozzles of other makes.

Write for Leaflet 901





For HEAVY DUTY DIESELS

An exceptionally versatile and convenient test set for checking nozzles and unit injectors of medium and large bore and stroke Diesel engines for marine, railroad and general industrial applications. Test set comes complete with fuel inlet connection fittings for American Bosch T, U and V size nozzles, Bendix-Scintilla C and D size nozzles, Fairbanks, Morse nozzles for 38D8-⅛ engines, and Electro-Motive 567 and 278A injectors. Fuel inlet connections to suit other specific requirements furnished promptly on receipt of specifications.

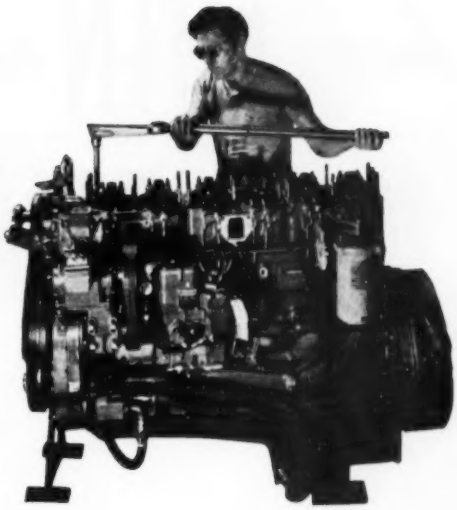
Write for Bulletin 634

This equipment is available in the two complete test sets illustrated, or may be purchased selectively in group assemblies for testing a particular type or related group of nozzles or injectors.

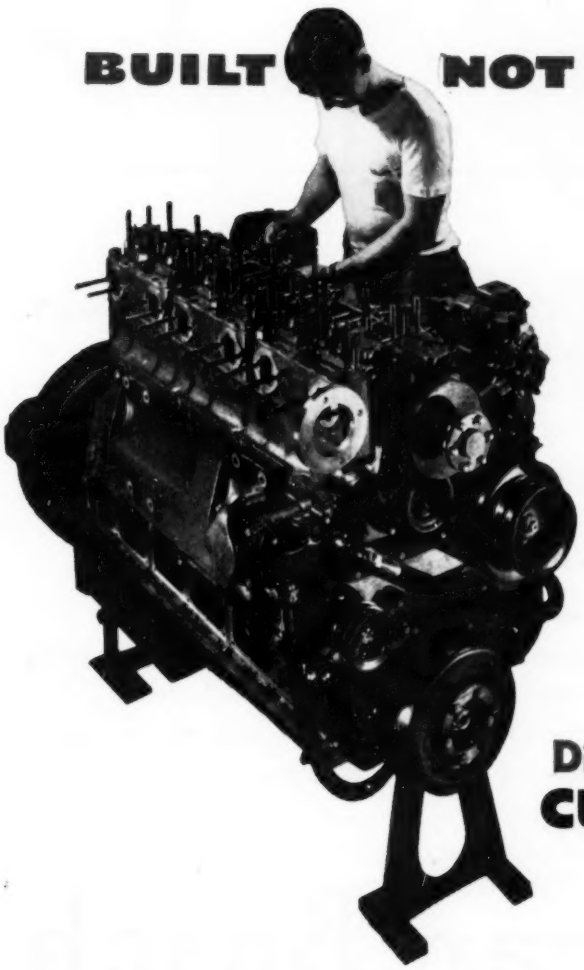
BACHARACH INDUSTRIAL INSTRUMENT COMPANY

7000 BENNETT STREET • PITTSBURGH 8, PA.

Cummins®
CUSTOM BUILT Diesels



BUILT NOT ONCE BUT TWICE



Each rugged, lightweight *and* high-speed Cummins Diesel is actually built *twice*. It's assembled, run-in tested, disassembled . . . inspected . . . then reassembled and tested again. And each engine is custom-built *to fit the job*. *Extra* care in building, Cummins exclusive fuel system, efficient service and parts organization, enable users to get *less* "down-time", *more* power and profits from Cummins Diesels. *See your Cummins Dealer.*

Diesel power by CUMMINS

CUMMINS Dependable DIESEL

CUMMINS ENGINE COMPANY, INC., COLUMBUS, INDIANA

Export: CUMMINS DIESEL EXPORT CORPORATION • Columbus, Indiana, U.S.A. • Cable: CUMDIEX

Lightweight High-speed Diesel Engines (50-550 hp)
for: on-highway trucks
off-highway trucks • buses
tractors • earthmovers
shovels • cranes
industrial locomotives
air compressors
logging yarders and loaders
drilling rigs
centrifugal pumps
generator sets and power units
work boats and pleasure craft

how THIN *is a* SHADOW?

Can you picture a millionth of an inch? About the thickness of a shadow would come close to describing it. Yet—parts for American Bosch diesel fuel injection equipment are produced to accuracy tolerances of millionths of an inch every day *on a production basis.*

Such precision manufacture explains the dependability of diesel fuel injection equipment supplied by American Bosch.

Combined with constant development and field engineering and extensive service facilities, it helps explain, too, why American Bosch-equipped diesel engines continue to set new standards of efficiency and economy in ever-widening fields of application.

AMERICAN BOSCH

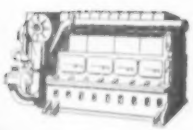
American Bosch

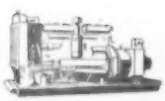
MAGNETOS • GENERATORS • VOLTAGE REGULATORS • IGNITION COILS
ELECTRIC WINDSHIELD WIPERS • DIESEL FUEL INJECTION EQUIPMENT

AMERICAN BOSCH CORPORATION • SPRINGFIELD 7, MASS.

Diesel Engine Staying Power

Upped





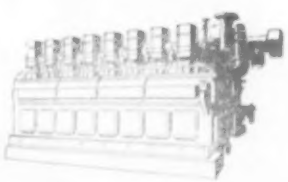
BY THESE 4 STEPS

1st step: Examine Cities Service lubricants for out-and-out quality through your purchasing experts or test facilities . . . or from service records established by critical users.

2nd step: Look into the completeness of the Cities Service line as an aid to simplified ordering and prompt, steady supply . . . backed by the extensive facilities and intensive cooperation to keep you out of any lubrication "jam."

3rd step: Review today's most effective Diesel lubrication practices by consulting that fully informed specialist, the Cities Service Lubrication Engineer.

4th step: Ask for facts about the high character of the Cities Service line and the practical technical assistance now upping Diesel staying power for many of industry's "hardest drivers." Phone or write CITIES SERVICE OIL COMPANY, Room 107, Sixty Wall Tower, New York City 5.



CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

"SQUISH

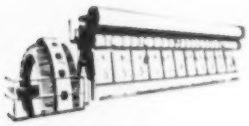
BALDWIN
BLH
LIMA-HAMILTON

Lima-Hamilton Division

BALDWIN-LIMA-HAMILTON

BALDWIN LIMA

ACTION"



helps HAMILTON squeeze more horsepower from fuels

One of the very few large diesels completely redesigned since the war is the new Hamilton 21-SA. As a result, it includes all those new engineering advancements that mean *more horsepower* from every drop of fuel.

Take the scavenging and combustion system, for instance. It's new . . . *and completely different.*

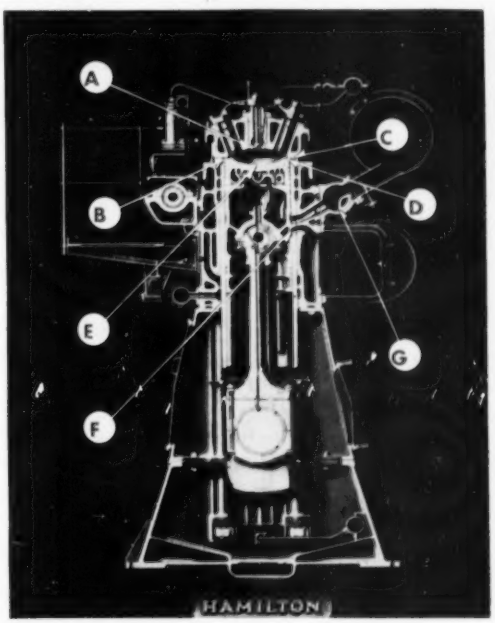
Exclusive rotary valves, a semi-hemispherical combustion chamber made by a cup-topped piston and recessed cylinder head, proportioned porting and an annular wall chamber, *trap 40% more air in the cylinder.* Then combine to squeeze this extra air into the fuel spray cone just as the piston reaches top dead center and as combustion is getting started.

That's "Squish Action!" . . . the secret of the better efficiencies of the Hamilton 21-SA.

Which in turn explains why this Hamilton 21-SA diesel gives *more horsepower* per cylinder size and speed than any other equivalent engine. And why it can burn the heaviest fuel with a clean exhaust . . . give the same output ratings on *both* dual fuel and diesel cycles.

Yet this is just one of the unusual features of this unusual diesel. So why not get in touch with us for *complete* information. There's no obligation.

Hamilton 21-SA diesels are available for marine or stationary applications either dual fuel or straight diesel. Built 5 to 12 cylinders with output range from 2250 to 6860 hp. at 240 to 277 rpm.



A. Recessed Cylinder Head

B. Flat on Cylinder Head

C. Annular Space

D. Flat on Piston Crown

E. Cupped Piston Crown

F. Looped Scavenging System with Proportioned Porting

G. Exclusive Rotary Valve

MORE POWER — LESS FUEL
CLEAR, COOLER EXHAUST

CORPORATION Hamilton, Ohio

- HAMILTON

Diesel Power and Diesel Transportation

"We are adding thousands upon thousands . . ."

FRANK M. FOLSOM
President, Radio Corporation of America

"By a simple person-to-person canvass, we are adding thousands upon thousands of serious savers to our Payroll Savings Plan. Our employees are eager to contribute to the strengthening of America's defenses while they build their own security. They know that individual saving initiative means a blow at ruinous inflation. They know that is the line on which all of us at home can make our strongest fight."

"Thirty days has September." And every one of these September days is a D Day. In newspapers . . . magazines . . . over the radio . . . from the television screen . . . on billboards . . . contributed advertising will urge every American to "Make today your D Day. Buy U.S. Defense Bonds."

September days are "D" Days for management, too —*Decision Days.*

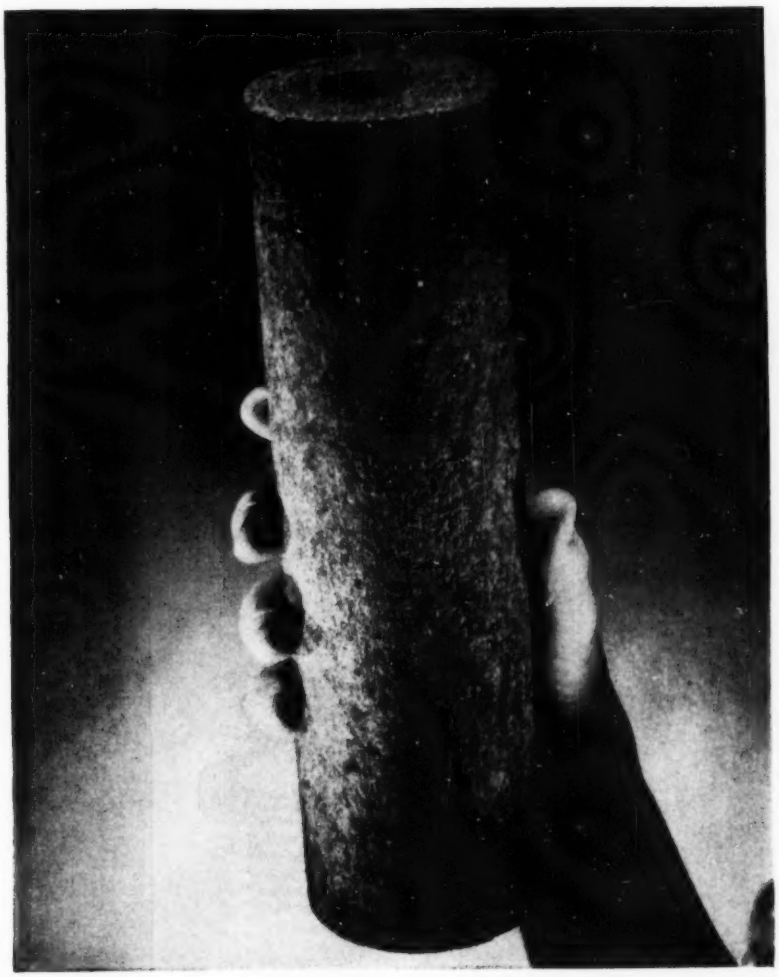
If you have a Payroll Savings Plan and your employee participation is less than 50% . . . or if you have not made a person-to-person canvass recently—consider this *your* "D" Day.

Phone, wire or write to Savings Bond Division, U. S. Treasury Department, Suite 700, Washington Building, Washington, D. C. Your State Director will show you how easy it is to increase your employee participation to 70%, 80%—even 90%—by a simple person-to-person canvass that places an application blank in the hands of every employee. He will furnish you with application blanks, promotional material, practical suggestions and all the personal assistance you may desire.

Your employees, like those of the Radio Corporation of America and many other companies will join by the hundreds or thousands because they, too, are eager to contribute to the strengthening of America's defenses while they build their own security. Make it very easy for them—through the automatic Payroll Savings Plan.

The U. S. Government does not pay for this advertising. The Treasury Department thanks, for their patriotic donation, the Advertising Council and

DIESEL POWER



The Simplest Filter Cartridge Lasts the Longest...Twice as Long

Cartridge renewals are cut at least *in half* when Cuno MICRO-KLEAN replaces any other filter. And throughout its service life, MICRO-KLEAN is *guaranteed* for specific performance.

CUNO

Fluid Conditioning

Removes More Sizes of Solids from More Kinds of Fluids

Strain fuels, lubricants, process fluids, etc.—AUTO-KLEAN
Filter fuels, lubricants, process fluids, etc.—MICRO-KLEAN
Clean raw water, recirculating water, etc.—FLO-KLEAN

The Diesel is a Simpler Engine . . . Here's the Simplest Filter

There is nothing complicated about the Cuno MICRO-KLEAN filter, and it fits the requirements of Diesel fuel and lube better than any other filter on the market.

The MICRO-KLEAN is *all filter*—a single, compact structure of "felted" fibres with no internal or external supports to take up space and complicate installation.

The cartridge is mechanically strong due to resinous impregnation and polymerization. It works "mechanically" that is, merely by *obstructing* passage of impurities, rather than by absorption or chemically. It neither removes additives, nor is affected itself by crankcase acids, moisture or other damaging agents. It won't swell or shrink, soften or harden, rupture or channel —or otherwise become distorted to restrict flow or release contaminants to clog injectors or damage parts being lubricated.

Seven Times Longer Life

A railroad, testing competitive makes for its locomotive fuel lines, found MICRO-KLEAN life seven times longer! MICRO-KLEAN gets this greater dirt capacity from its maximum porosity (85-90%) and from its exclusive "graded density in depth", permitting smaller particles to penetrate further, rather than "loading" the surface.

Cuno MICRO-KLEAN, on Diesel fuel or lube, is guaranteed to remove 100% of all solids for which it is rated*, plus a large percentage down to 1 micron.

*10,25,50 microns. Capacities: from a few to over 800 gpm.

CUNO ENGINEERING CORPORATION
Dept. 255C, South Vine Street, Meriden, Conn.

Please send information on Cuno MICRO-KLEAN for Diesel service.

Name.....Title.....

Company.....

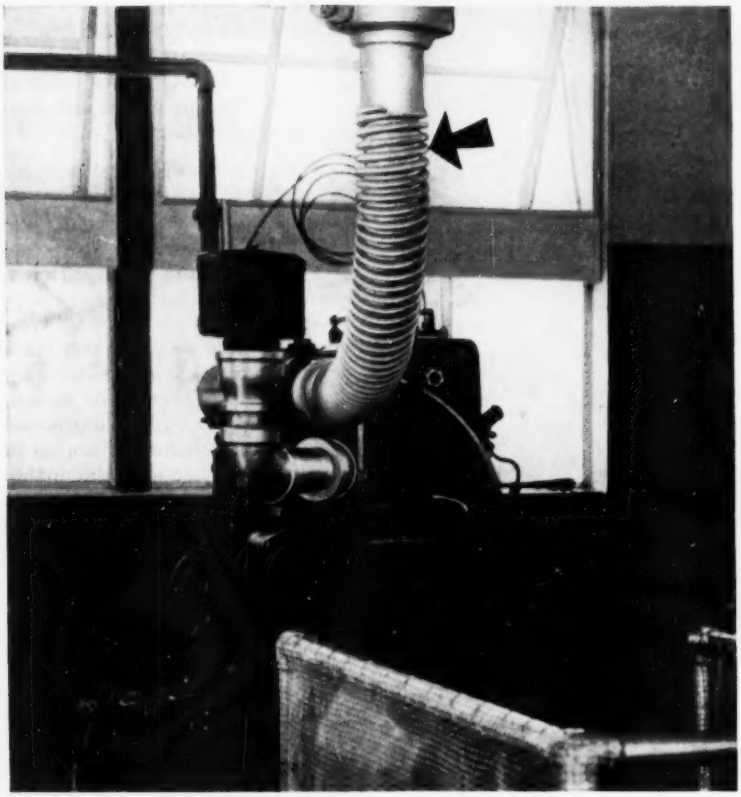
Address.....

City.....Zone....State.....

Please attach to business letterhead

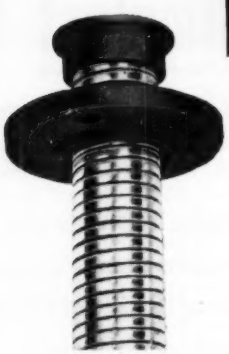
Easy-to-Install, Vibration-Proof,

American **FLEXIBLE** Metal Hose for Diesel Installations



Flexible Metal Hose on diesel exhausts and air intakes is simple to install where offset connections are involved. You just bend it to the curves required.

Flexible Metal Hose effectively absorbs line vibration and adjusts itself to thermal expansion and contraction—and thus is free from all shear and vibration stresses.



American Flexible Steel Exhaust or Air Intake Hose is available in *two* types: Corrugated Steel; and Interlocked Steel. Both are gas-tight, strong and able to withstand extreme service temperatures. For full details on both these logical products for diesel exhaust and air intake lines, just write for Bulletin EH-50, to The American Brass Company, American Metal Hose Branch, Waterbury 20, Connecticut. In Canada: The Canadian Fairbanks-Morse Company, Ltd.

81256

wherever connectors must move...

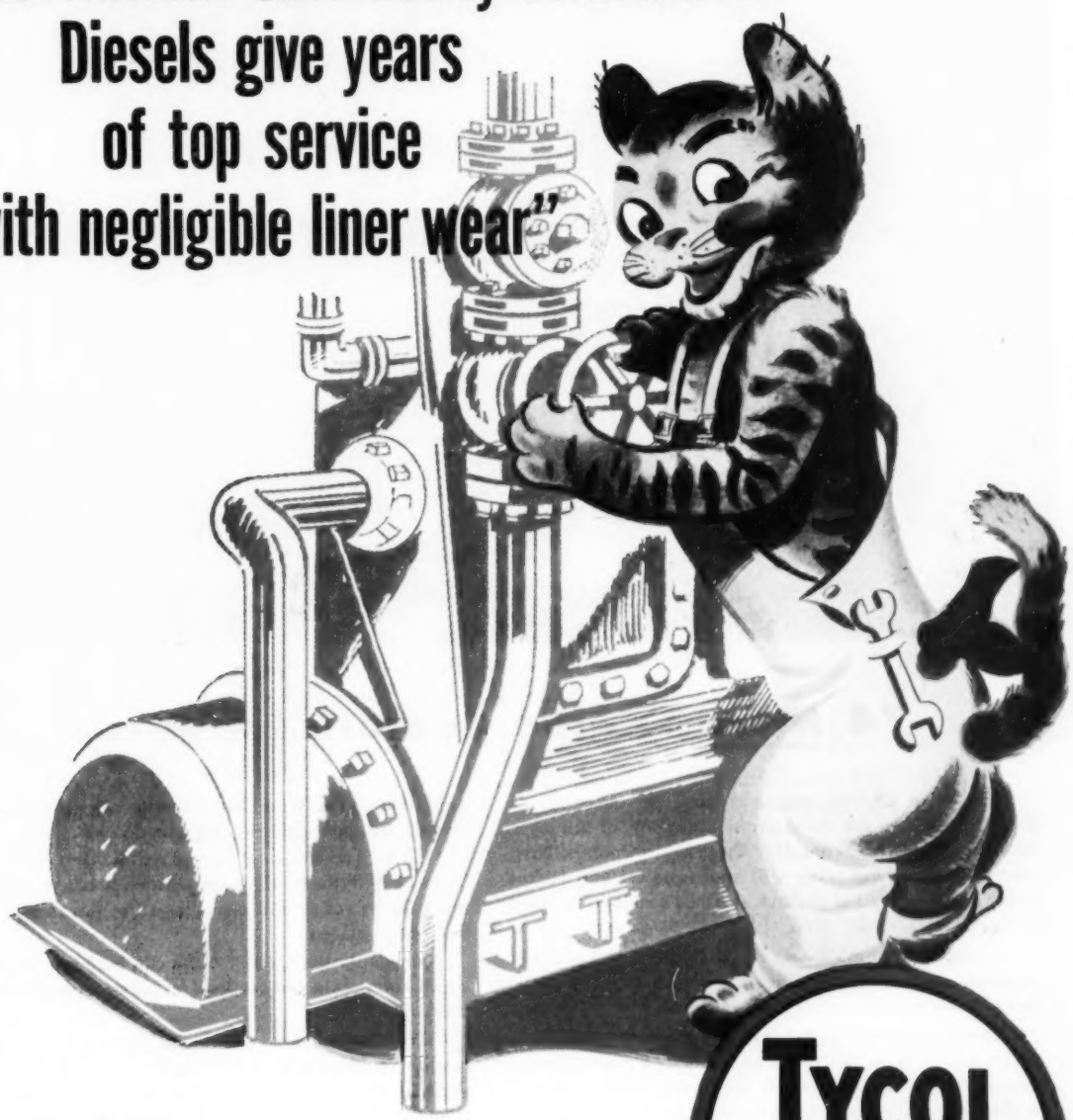
American ANACONDA

FLEXIBLE METAL HOSE AND TUBING

Other Products for Diesel Use

Connections for carrying OIL, AIR, WATER, EXHAUST, ETC., UNDER ROUGH MECHANICAL AND TEMPERATURE CONDITIONS. Write for literature.

"Tycol Adelbus cuts costly overhauls... Diesels give years of top service with negligible liner wear"



Exactly! Tycol Adelbus Diesel Oils are fortified with selected additives that provide a tough "film of protection," and help to eliminate sludge and varnish. They have excellent detergent-dispersive characteristics and amazing resistance to heat . . . assure the piston seal that means FULL power and economy . . . and provide exceptional resistance to oxidation.

Complete information about Tycol Adelbus Diesel Oils is available from your nearest Tide Water Associated office. Call or wire now.

TYCOL

INDUSTRIAL LUBRICANTS

Boston • Charlotte, N. C. • Pittsburgh
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TIDE WATER ASSOCIATED OIL COMPANY

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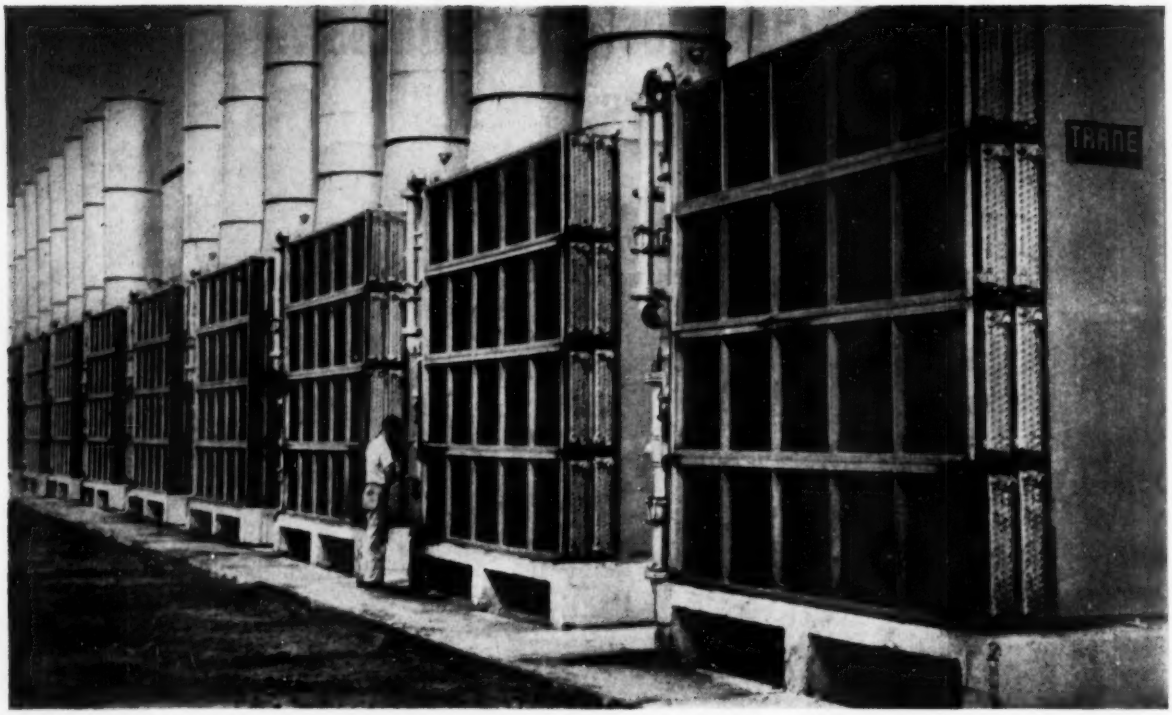


74 More Engine Coolers for Alcoa

For more efficient engine cooling, for more aluminum production, the Aluminum Company of America has again called on Trane Dry Type Fluid Coolers. Now *almost 200* of these units will cool lube oil and jacket water of the big radial engines at Alcoa's reduction plant in Texas.

Almost 200 giant Trane Fluid Coolers will provide complete engine cooling efficiency without using water and requiring only a minimum of power!

These units can cut gas or diesel engine cooling costs to the quick. With flat plate-type fins and round tubes, the core of the unit offers less resistance to the air flow, so the unit needs less horsepower to do its cooling job. Heat transfer is faster and more efficient, too. That's because the fins are mechanically (and permanently) bonded to the tubes, and because the fin collars form a continuous sheath around the tubes.

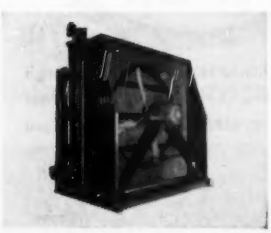
A wide variety of standard core headerings are available, so the Trane Fluid Cooler can provide just the circulation and heat transfer rate desired.

There's no water to treat or sediment to remove with Trane dry type fluid cooling. Core headers and tubes are easy to reach and clean, and the fan motor is conveniently placed.

Ruggedly built, these units can take the strains and shocks of mobile and outdoor installations without extra bracing.

The units are available in horizontal air stream models, in 14 sizes with fan diameters of 18" to 120" and vertical air flow models in 8 sizes with fan diameters from 72" to 144". Trane Fluid Coolers have steel casings, aluminum fans, copper or aluminum tubes and aluminum fins. The units can also be furnished in other materials and constructions.

Capacities range from 66,000 to 7,600,000 Btu per hour.



Rugged casing and motor support construction of horizontal air stream model.

Trane GC Fluid Cooler. Air flows upward through core, unaffected by wind direction.

Horizontal air flow Fluid Cooler, available in 14 sizes, either blow-through or draw-through fan.

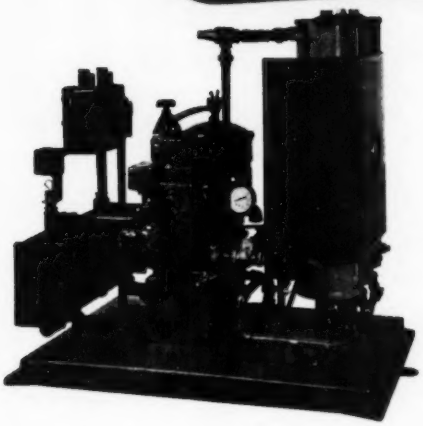
TRANE

MANUFACTURING ENGINEERS
OF HEATING, VENTILATING AND
AIR CONDITIONING EQUIPMENT

THE TRANE COMPANY, LA CROSSE, WIS.
Eastern Mfg. Division, Scranton, Pennsylvania
Trane Company of Canada, Ltd. . . . Toronto
OFFICES IN 80 U.S. and 14 CANADIAN CITIES

WHY THE DE LAVAL "PURI-FILTER"

PROVIDES MAXIMUM PROTECTION FOR YOUR DIESEL ENGINE



The De Laval "Puri-Filter" enables the diesel operator to secure the advantages of purifying diesel lubricating oil by centrifugal force and by positive filtration. The centrifuge removes most solid impurities and all water, and the filters complete the cleaning operation and also restore a good measure of color.

The De Laval "Puri-Filter" is a combination of the De Laval "Uni-Matic" Oil Purifier and Fram "Filcron" Filters. The unit is supplied complete with dirty-oil and clean-oil pumps, and is piped ready to operate. Electrical controls are provided, and all parts are compactly mounted on a sturdy metal base.

With the "Puri-Filter," diesel lubricating oil can be maintained truly ***clean*** and ***dry***—the maximum in protection for any engine.

Ask for Bulletin DL-1.

Note these Features

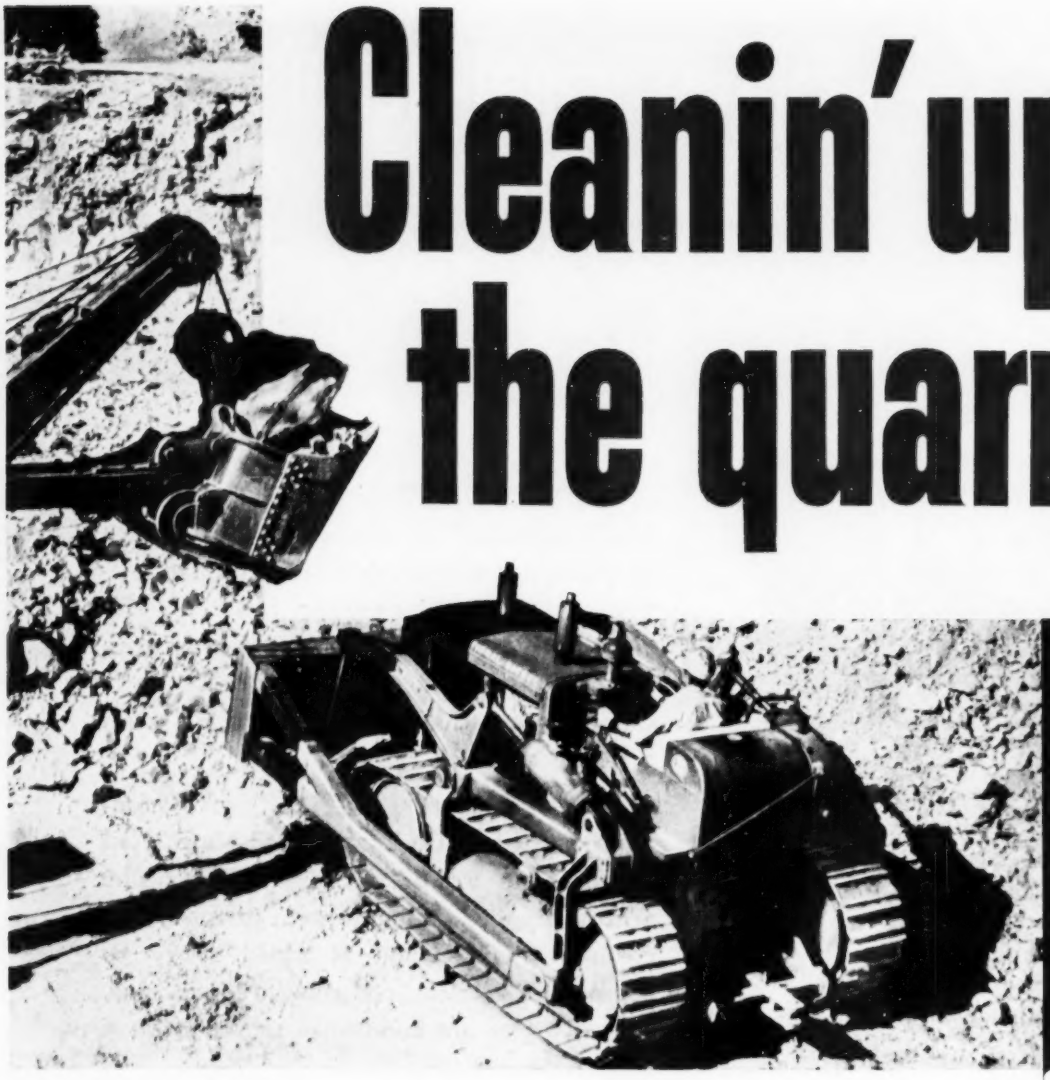
- **Removes dirt and water by centrifugal force**
- **Filters out harmful carbon**
- **Does not remove valuable additives**
- **Cleans oil at moderate temperature**
- **Speeds up inspection—crankcase is cleaner**
- **Minimizes ring sticking**
- **Increases bearing life**
- **Saves labor—long runs without bowl cleaning**
- **Increases oil life**
- **No dirt . . . carbon . . . or water**

THE DE LAVAL SEPARATOR COMPANY
Poughkeepsie, New York 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

DE LAVAL OIL PURIFIERS

FOR DIESEL LUBRICATING OIL

Cleanin' up the quarry



INTERNATIONAL

INTERNATIONAL HARVESTER

Arnold Graf's International TD-18 keeps production high, costs low in Molino, Missouri, quarry

Arnold Graf, Molino, Missouri, bought an International TD-18 crawler as production insurance for his limestone quarry two years ago. Here's what has happened since:

With the TD-18 doing everything from dozing 15-foot overburden to feeding the shovel and cleaning up the quarry floor, production zoomed to 700 tons a day. The crawler's 1,600-hour work record shows no downtime and no repairs.

POWER THAT PAYS

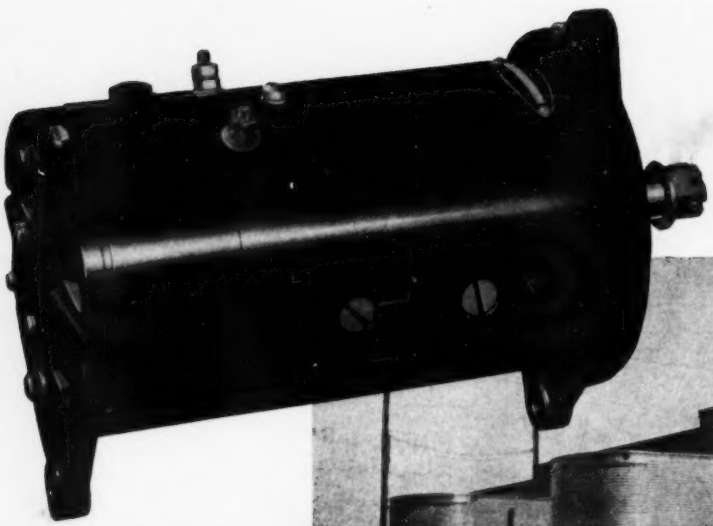
"We recommend the TD-18" says Mr. Graf, "to anyone with a tough piece of work to do. It has given us excellent service while doing the dozens of quarry jobs only this powerful crawler does best."

International crawlers defy the grit in your pit or quarry and give you greater production per power dollar. Ask your International Industrial Distributor for all the facts, including his after-sale policy. Then go ahead with International "Power that Pays!"

INTERNATIONAL HARVESTER COMPANY, CHICAGO 1, ILLINOIS

TAMES A
POWER THROB
FLEXINEERING ELIMINATES VIBRATION ON TUG DIESEL EXHAUST
. . . PROVIDES SMOOTHER POWER . . . COOLER OPERATION
When the giant 16 cylinder, 1750 horsepower diesel engine of the new tugboat, Grace Moran, roars into action, there's a smooth purr of silky power. And one of the keys to this vibration-free operation is "flexineering"—the scientific engineering of flexible metallic tubing to industry's specific needs.
From the exhaust to the stack is a five foot length of Penflex air jacketed 14 inch, interlocked, flexible metallic tubing which achieves a circulation of air and an efficient cooling action.
Tough, rugged tubing that keeps exhausts as tight as a pipe . . . yet provides all of the flexibility necessary to "soak up" the constant vibration.
In the power field—whether it is on exhaust lines, air lines or the many other places where tubing is used—you will find Penflex engineers ready to help you solve your problems. Penflex tubing is available in bronze, galvanized steel and stainless steel . . . in sizes from ⅛ inch I. D. to 24 inch I. D. Write for your copy of "Flexineering."
PENNSYLVANIA FLEXIBLE METALLIC TUBING CO.
7236 Powers Lane
Philadelphia 42, Penna.
Branch Sales Offices
BOSTON • NEW YORK • CLEVELAND
CHICAGO • HOUSTON • LOS ANGELES
Penflex... HEART OF INDUSTRY'S LIFE LINES

Copyright 1949—Penna. Flexible Metallic Tubing Co.



Delco-Remy heavy-duty 12 volt, 50 ampere generator.

SERVING THE DIESELS THAT SERVE AMERICA . . .

DELCO-REMY

Diesel-powered tractors continue to roll up per-ton-mile economy records in the freight haulage business.

Delco-Remy electrical equipment on the Diesels continues its remarkable record of dependable performance.

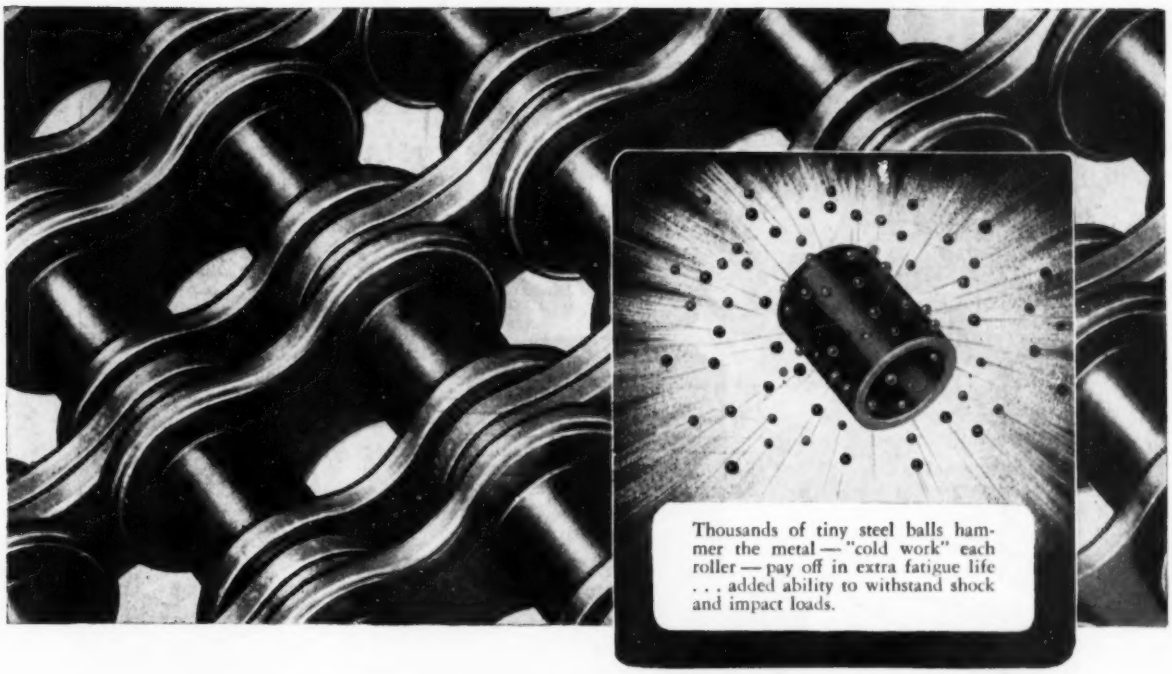
Since the earliest days, Delco-Remy has been privileged to serve the Diesels that serve America. Today, Delco-Remy electrical equipment is the standard of the industry.

DELCO-REMY—A UNITED MOTORS LINE
Service Parts and Delco Batteries
Available Everywhere Through
UNITED MOTORS DISTRIBUTORS

UNITED SERVICE MOTORS

Delco-Remy
DIVISION, GENERAL MOTORS CORPORATION
ANDERSON, INDIANA

DELCO-REMY • WHEREVER WHEELS TURN OR PROPELLERS SPIN


Thousands of tiny steel balls hammer the metal — "cold work" each roller — pay off in extra fatigue life . . . added ability to withstand shock and impact loads.

Why you should be sure the roller chain you buy has

SHOT-PEENED ROLLERS

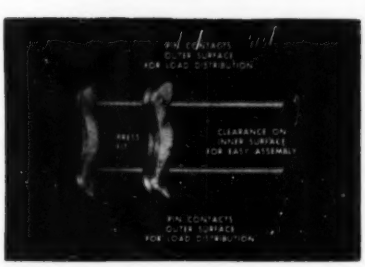
. . . one of the extra-strength features you get with every LINK-BELT Roller Chain

LOOK for the distinguishing darkened rollers on every roller chain you buy! They're your guarantee of extra fatigue life.

Shot-peening is just one of the added manufacturing refinements that make Link-Belt Precision Steel Roller Chain a longer-life chain. Controlled material selection and heat treating assure absolute uniformity . . . no weak members.

Link-Belt Roller Chain is available in single or multiple widths, in ⅜ to 3 in. single and double pitch. For the best in roller chain, get in touch with your nearest Link-Belt office.

Easier coupling and uncoupling without sacrificing load distribution



Patented E-Z Assembly feature of Link-Belt Precision Steel Roller Chain has won world-wide approval. Coupling and uncoupling of multiple width chains—right on the job—is far easier. There's absolutely no sacrifice of load distribution . . . no loss of the chain's remarkable performance. Press-fits between chain pins and middle bars have been modified. But full load-carrying capacity across the entire width of the chain has been maintained.

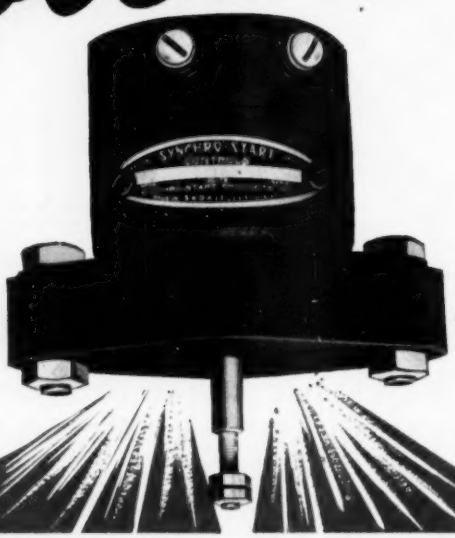
LINK-BELT

PRECISION STEEL ROLLER CHAIN

LINK-BELT COMPANY: Indianapolis 6, Chicago 9, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices, Factory Branch Stores and Distributors in principal cities. 13.350

Continuous Duty
FOR DIRECT CURRENT WORK

Solenoids



The Synchro-Start Solenoids are small and ruggedly constructed in a dust and splash proof case. They are used for operating throttles, fuel pump racks, chokes, anti-dieseling devices and controls.

Technical Data

Dimensions—4½" x 3⅞" Voltages—6, 12, 24 and 32

Shipping Weight—3 pounds 10 pound pull with ½" stroke

Current Consumption—220 W pulling, 6.5 W holding
Either grounded or ungrounded

***For further information ask for* BULLETIN 410**

SYNCHRO-START PRODUCTS, INC.
Automatic Engine Control Equipment

For all high pressure testing

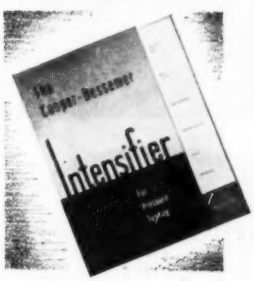
THE Cooper-Bessemer intensifier offers new advantages, new economies, wherever pressure testing is desired . . . for boilers, piping, compressor cylinders, pumps, *all* kinds of pressure vessels and laboratory destruction tests.

Completely air driven, the new intensifier eliminates fire and explosion hazards of motor-driven equipment, and easily develops hydrostatic pressures up to 23,000 psi using air at 90 lbs.

The extreme compactness and portability of the unit is another obvious advantage. It weighs less than 80 pounds, rolls easily to any job or location. Its completeness, versatility and low purchase price will also appeal to you . . . will save you still more dollars!

The intensifier is available in two sizes—Model 10 for testing with water up to 10,000 psi and Model 23 for testing with oil up to 23,000 psi. For complete information send to any Cooper-Bessemer office for a new bulletin.

SEND FOR THIS BULLETIN!



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Cooper-Bessemer
Corporation

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KEEPING UP TO DATE ON

COOK

Graphitic Iron Piston Rings

HAS PAID OFF IN BIG PROFITS!

• "Much has been published about Cook piston rings—but I keep up-to-date by using them—I see the results.

"Recently on changing to a heavier fuel I encountered difficulties. From a Cook Engineer I learned that Cook had developed a special ring to meet these new conditions. It corrected my trouble.

"Then I was disturbed with crankcase pressure build-up. Again I learned Cook had the ring to correct this condition.

"Over the years, Cook has helped me eliminate cylinder lacquer—blow-by—high rate of cylinder wear—frequent ring replacement and ring breakage—just to mention the more important ones.

"Yes, in using Cook Rings I buy experience, because I get 'job engineered' rings for my specific conditions.

"Take a tip from me—keep up-to-date on Cook Rings—it will pay off in big profits."

★ ★ ★

C. Lee Cook Mfg. Co., Incorporated, Louisville, Ky. Branch offices in Baltimore, Boston, Chicago, Cleveland, Houston, Los Angeles, Mobile, New Orleans, New York, San Francisco and Tulsa.

COOK
GRAPHITIC IRON
PISTON RINGS

You, too, will profit by using Cook "job engineered" rings. If you have a piston ring problem, let Cook solve it. That's Cook's business.

SEALING PRESSURES SINCE 1888

Diesel Power
and DIESEL TRANSPORTATION

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Vol. 29 No. 9 September, 1951

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Cover Photo:
First industrial installation of Enterprise's "M" Series engines shown in the Antelope Pumping Station of Union Oil Co. of California. Crude from the line is burned. Engines drive Wilson-Synder quintuplex pumps through Pacific Western gears.

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SPECIAL FEATURE

Experiental High Speed Cummins Engine 36

Outlining the high points in the development of the truly high speed engine used in Cummins' Indianapolis race car. The research provided important data for future commercial developments.

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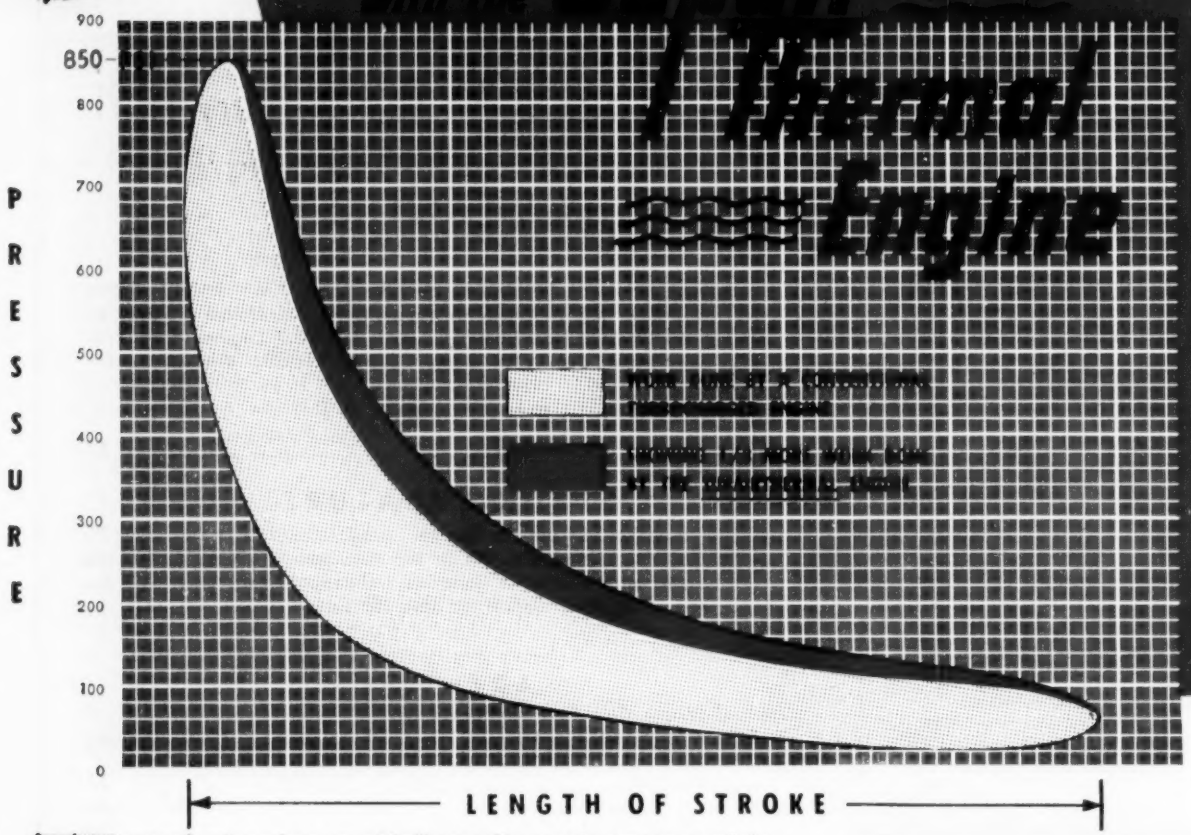
Here it is...

ONE-THIRD MORE POWER

with the Supair Thermal Engine



THIS reproduction of an actual indicator diagram is a measure of the average pressures within the cylinders of the *SUPAIRTHERMAL* Engine* and a conventional turbocharged engine. The darker area shows the amount of work being done by each piston in the conventional engine. The *solid red* area shows the *increase in the amount of work* done by each piston in the Nordberg *SUPAIRTHERMAL* Engine—*resulting in an increase of one-third in horsepower without increasing the maximum combustion pressure or the internal temperatures.*

Here, then, is actual proof that the Nordberg *SUPAIRTHERMAL* Engine *is* the outstanding engine of the Diesel field . . . delivering one-third more horsepower in the same space as a conventional turbocharged engine.

The *SUPAIRTHERMAL* Engine is available in a full range of 4-cycle types for fuel oil, Duafuel, or spark ignition gas operation, in sizes from 425 to 3200 B.H.P. Write for further information on the *SUPAIRTHERMAL* Engine, outlining your power requirements. *(Patents Pending).

NET RESULTS:

• 1/3 MORE HORSEPOWER IN SAME FLOOR SPACE • MORE HORSEPOWER PER GALLON OF FUEL • MORE HORSEPOWER HOURS PER GALLON OF LUBE OIL • INCREASED THERMAL EFFICIENCY • LESS HEAT LOSS TO WATER JACKETS • LESS WEIGHT PER HORSEPOWER • LOWER INSTALLATION – OPERATING – AND MAINTENANCE COSTS.

NORDBERG MFG. CO., Milwaukee 7, Wis.

P-SM251

BUSCH-SULZER
A DIVISION OF NORDBERG

NORDBERG
DIESEL ENGINES

NORDBERG MACHINERY

Editorial

Iranian Oil

LAST MONTH, we quoted Mr. Charles E. Wilson briefly on the subject of Iranian oil. Since that time, things have come to an impass as is apparent to anyone who reads the papers. It appears to us (and probably to most other people) that the Iranians are being a bit on the ridiculous side. A major portion of their national income is derived from the oil industry and by pursuing their present policy they stand to lose it to a very great extent.

We do not argue the merits of ethics of the British case but we do feel that operations should have been continued while they tried to wangle the best possible deal for themselves. As it stands now they have the oil but no means of refining it, shipping it or merchandising it. Net result: no dough.

One heartening point was expressed to us by a visitor from the scene. He contends that the oil would be of little practical value to the Russians. Some could conceivably be shipped by tanker for their own consumption but think of the vulnerability of their supply line in the event—God forbid—that the cold war should turn hot. Pipelines to Russia—out of the question, and rail transportation would only provide a trickle at the very best. Why? Our informant explains that the entire northern boundry of Iran is mountainous and that elevations of about 6000 ft. must be traversed. Anyone want to volunteer to design the pipe line for this pumping head? Anyhow, its a consoling interpretation of the situation.

Should anyone be wondering why we are so upset about the subject, we hasten to explain. We are currently oil importers, to the tune of nearly a million bbl. per day; have been since along about 1947. Also, we have assumed foreign commitments which we cannot ignore if only for our own protection in the form of a strong Europe. Much of Europe's oil came from Iran.

Now this oil has been cut off and must come from some other source or the European program will suffer. Increased shipments from Saudi-Arabian and other Middle-East sources are helping to fill the hiatus and time alone will tell if sufficient quantities can be obtained without robbing other areas.

In the event that the Western Hemisphere has to contribute to any great extent, our supply of petroleum products will become tight. It could result in rationing and would undoubtedly result in some shortages. The distillates would certainly suffer as the last drop of aviation gas, regular gas and jet fuel, etc., was wrung from the available stocks.

Any shortage of distillates, real or threatened, is not a healthy situation for the diesel industry. That is the time when the attacks start as was the case a few years ago when the increased dieselization of the railroads was under fire as creating a shortage of oil for house heating. Also, as in this case, the action is not necessarily supported by fact. During such periods, uncertainty, misinformation and—yes—propaganda, leads prospective purchasers of diesels to turn to some other prime mover.

This is reason enough for some concern. In fact, consternation is felt in the "high places" and we read about plans to offset the effects if this folly should persist. At the time of writing, it is estimated that more than 30 million bbl. of crude oil and refined products have been lost to the free world. This is already placing a heavy strain on the producing and refining capacity of the American petroleum industry and it may get worse.

Arrangements have been made to step up crude oil production in the Middle-East and the Caribbean areas by about 230,000 bbl. per day. In addition, oil companies are taking action to divert 200,000 bbl. a day of Middle-East crude oil to European and other Eastern Hemisphere refineries. This crude would normally come to the East Coast of the U.S. and Canada. And still an estimated deficit of some 230,000 bbl. a day exists if the free world rearmament program is not to suffer.

The Foriegn Petroleum Supply Committee was established early in July under a voluntary agreement entered into by 19 American oil companies operating abroad. The agreement, under the terms of the Defense Production Act of 1950, provides for joint action under the direction of the Petroleum Administrator for Defense, to supply petroleum to friendly nations.

They have to get the oil, however, and what cannot be obtained through increased production must be supplied from domestic inventories, fortunately at a fairly high level. Obviously, this is a temporary expedient.

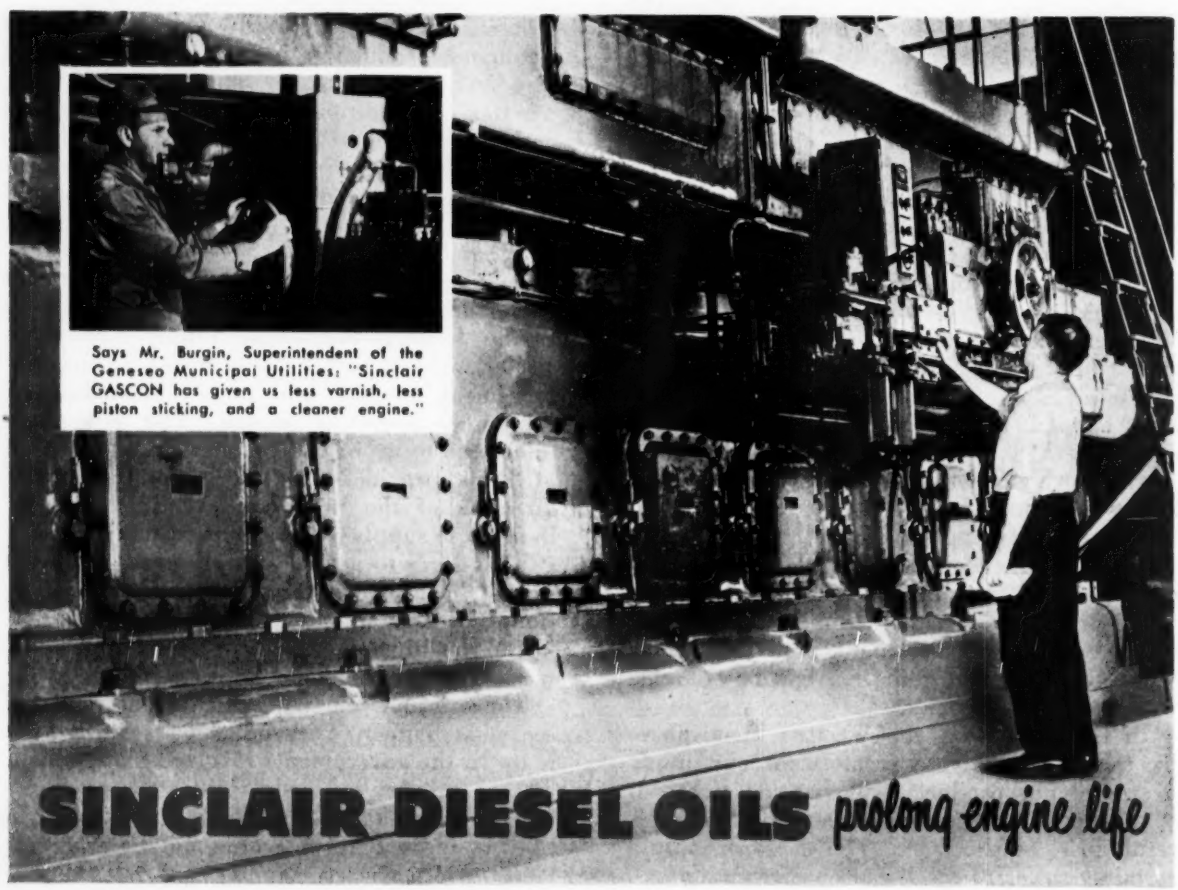
There is not much we can do but wait and see what happens with our fingers crossed. It is up to the governments involved and perhaps our oil industry can exert a little pressure. We just thought that we would pass the information along so that we would not be worrying alone. Better start thinking and planning.

Light Plant Solves Problems of Sticky-Rings and Carbon-Build Up

● For quite some time the Light Plant of Geneseo Municipal Utilities, Geneseo, Ill., had trouble with sticking rings, and with carbon deposits in the exhaust ports of its diesels. A few years ago these diesels were changed over to Sinclair Gascon *D*. Almost at once, it was noted that the troublesome conditions started to clear up. In the time since, sticking rings have become the rare exception and the carbon deposits are no longer a problem.

Furthermore, in 1947, a 1400 hp. Fairbanks-Morse engine, shown below, was installed and filled with Gascon *D*. This engine has never had a sticking ring and is running remarkably clean, with exceptionally low cylinder wear.

Perhaps Gascon® Oil can cure *your* diesel troubles, too. Get in touch with your nearest Sinclair Representative or write Sinclair Refining Company, 600 Fifth Ave., New York 20, N. Y.


Says Mr. Burgin, Superintendent of the Geneseo Municipal Utilities: "Sinclair GASCON has given us less varnish, less piston sticking, and a cleaner engine."
SINCLAIR DIESEL OILS prolong engine life

+ HIGHLIGHTS +

● Of 42 billion in defense orders placed since Korea, only 10 billion in goods have been delivered so far.

● Production of primary aluminum in U. S. during first half, 1951 reached highest level since first half, 1944—807,181,724 lbs.

● Britain is tightening up its embargo to China—now banned are exports of internal combustion engines, motor vehicles, locomotives, rails, and electric generators.

● A Defense Materials Procurement Agency has been created by the President, to be responsible for critical and strategic materials supplies.

● England manufactured in March, 31,500 units of internal combustion units, aggregating 404,000 bhp., costing £3.6 million—the highest level so far.

● The Iraqui government has officialy refused to consider opening the branch of Iraq Petroleum Co. pipeline which runs from Kirkuk to Haifa, Israel. This branch has been closed since the Israel-Arab war.

● Army has established a Joint Military Packaging Course at Rossford Ordnance Depot, Toledo. Industrial personnel at foreman or supervisory level can get training in basic military preservation, packaging, packing and marketing, if firm has military contract. Contact Officer in Charge.

● Kansas-Missouri flood hit the railroads hard. NPA has authorized immediate steel shipments to restore damaged facilities. In addition, more than 7000 critically needed freight cars were under water, many being derailed.

● July production of freight cars amounted to 5290—a substantial drop from the June deliveries of 9644.

● Pennsylvania Railroad reported today that 90 per cent of its program to build new and rehabilitate 60,000 freight cars has been completed.

● Subcontractor exhibits to enable small businessmen to examine military items which they might make under subcontracts, are being organized by the Armed Forces Regional Councils.

● Crude oil production in the United States hit a new all time high of 6,231,250 bbl. per day in the week of August 11.

● GM recently announced an upward revision in its cost-of-living allowance to approximately 394,000 eligible hourly-rated and salary employes for the rise in the cost of living since last April 15.

● Junior engineers, reading accounts of fabulous salaries offered beginners, may be in for a big disappointment when they find average is closer to $3,300.

● To offset the oil shortage created by the Iranian situation, a plan has been proposed to 19 oil companies operating abroad to pool their resources throughout the world. Immunity from anti-trust prosecution is guaranteed.

● A new 550-ton open hearth furnace was recently placed in operation by the Weirton Steel Co. in the expansion program that will raise the annual output of the National Steel Co., the parent concern, to 6,000,000 tons per year.

● Truck haulage increased in this country from 50 billion ton-miles in 1941 to an estimated 115 billion ton-miles in 1950.

● Australia has been producing motor gasoline and allied products on a commercial basis from native shale.

● Western Europe's industrial production has hit a new peak of 44 per cent above prewar output. At the same time Marshall Plan purchase approvals decreased nearly 40 per cent.

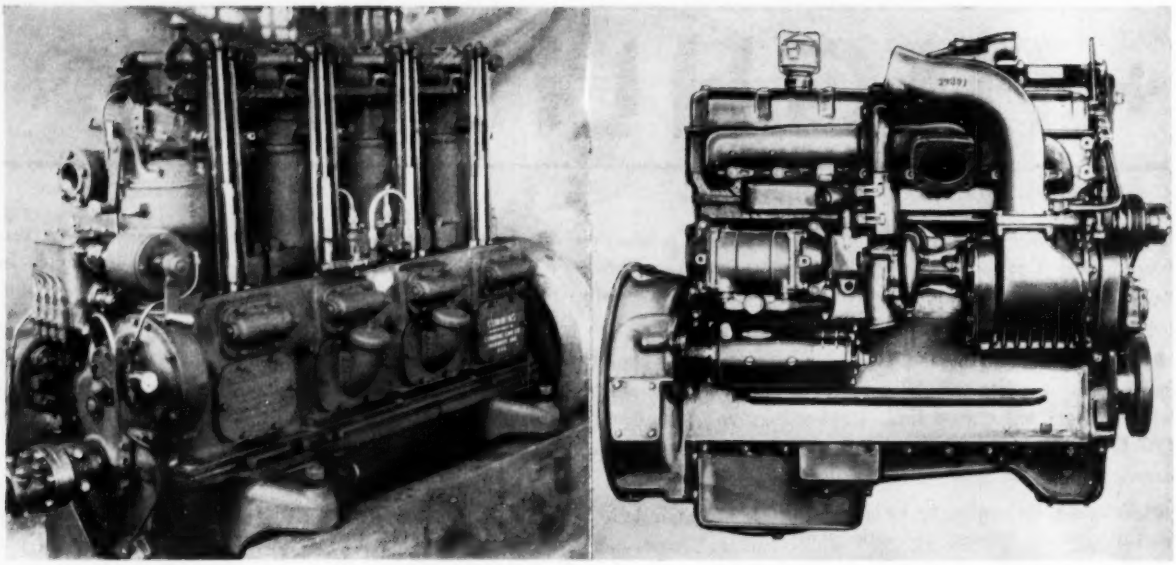
● America's rural highways will require $30 billion dollars for repairs to bring them up to modern standards, according to an official of the American Road Builders' Association.

● Production levels for the fourth quarter for the automobile industry have been set at 1,100,000 cars or 60 per cent of first-half 1950 base period production.

● Action to break the bottleneck in the defense production program, due to a shortage of machine tools, is being taken. Revision of the price structure, super-priorities on basic construction materials, and adequate manpower are being assured to the industry.

● It is estimated that the average age of a motor vehicle before scrapping has doubled since 1925, and the average accumulated mileage has quadrupled.

● During the period July 19 to August 17, the Canadian Pacific RR received 300 50-ton box cars on a 1300 car order. Also received were one 800-hp. diesel-electric switcher from GM Motors Diesel Ltd., and two 1600-hp. diesel electric freight units from the Montreal Locomotive Works.



Experimental High Speed Cummins Engine

*by N. M. Reiners and R. C. Schmidt**

In 1913, Mr. C. L. Cummins organized what is now the Cummins Engine Company, Inc. Actual manufacture of engines in limited quantities began in 1919. In about 1924 the present Cummins fuel injection system was conceived, arousing serious contemplation of the possibilities of a high speed automotive type diesel. The first Cummins diesel turned 900 rpm. Since that time the speed has been increased to 2500 rpm. The 1950 Indianapolis "500 Mile" Race offered an occasion to develop and build an engine requiring the maximum possible speed.

- *Could the fuel system be made to meet requirements for wide range operation at the 4000 rpm. speed?*
- *Could commercially available fuels and lubricants be used?*

Technical objectives were to surpass the maximum of 168 bmep. developed by production engines in laboratory tests with rotative speeds of 4000 rpm. considered within the realm of possibility.

Underlying objectives were to accelerate development and add to the store of knowledge of higher speed operation with an eye to possible future commercial developments. Specifically, answers were sought to the following questions:

- *Would thermal and mechanical efficiencies be acceptable?*
- *What thermal, mechanical, lubrication and structural problems would be encountered?*

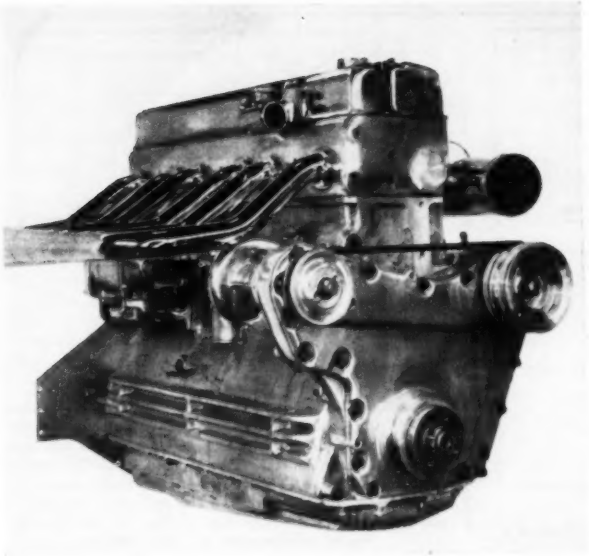
AS envisioned in the development program, the engine had to be relatively small. Thus, it would fit a wide range of installations and be competitive with a wide range of engines. It had to be low in weight, indicating aluminum construction. High rotative speed would give not only high brake horsepower, but also flexibility in operation.

The size requirement was met by the production JS engine. It had a 4⅛-in. bore and 5-in. stroke and was rated 150 bhp. at 2500 rpm. Designated the "JSX", it surpassed the program objectives, developing 345 bhp. at 4000 rpm. Weight was only 840 lb.

Basically the same as the stock engine, there were some outstanding differences. The fuel metering system was experimental. Aluminum construction was used wherever possible including the highly loaded main bearing caps. Intake and exhaust manifolds were placed on opposite sides of the engine and four valves were used in place of the conventional two. The small side-mounted Roots type supercharger, running at twice engine speed, was replaced by a larger unit mounted at the front end of the crankshaft and driven at engine speed through a flexible coupling.

This arrangement reduced the possibilities of drive troubles and assured

*Cummins Engine Company, Inc. Abstracted from a paper presented by the authors at the SAE Summer Meeting, June 3-8, 1951.



Three stages of development of Cummins' engines. At far left is the old Model "W", which developed only 70 hp. Center is the JBS-11 which was used as a basis for the high speed experimental JBX engine at right

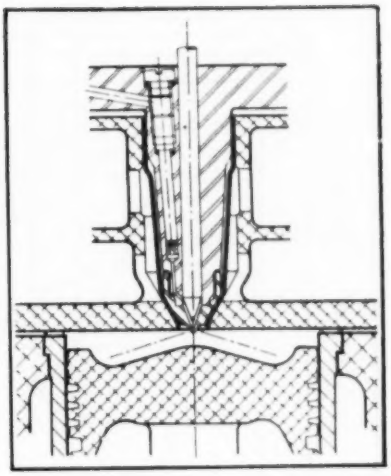


Fig. 1—A section through the Cummins' injector as well as the final combustion chamber of the JSX engine

higher blower efficiency. It should be noted that the maximum output obtained was limited by the size of the blower selected at the beginning of the project.

Fuel System and Combustion Chamber

The injector and combustion chamber are the most important parts of the engine affecting the combustion process. The injector was of the standard Cummins type. It is basically a constant stroke, positive displacement pump. The plunger reciprocates along a controlled path fixed by the injector cam shape.

The plunger passes through four phases during each cylinder cycle: First, a period of dwell during which fuel enters the injector cup; second, injection of the charge as the cam forces the plunger down; third, a period of dwell with the plunger tip resting solidly in the cup, preventing dribble and sealing against entry of combustion gases; and fourth, retraction in preparation for the next charge. Engine speed and load are controlled entirely by the quantity of fuel charge entering the cup.

During plunger retraction, metered fuel enters the cup but does not fill the cavity. The remaining portion fills with compressed and heated air that prepares the fuel in the cup before actual injection.

During early compression of the air fuel mixture, it follows the rules for compressible fluids, producing a relatively slow rate of discharge. Soon the mixture is compressed to a "solid mass" and the rate of pressure rise in the cup increases sharply. Other conditions being equal the rate of plunger travel during the main charge injection determines the degree of atomization, penetration and distribution of the fuel entering the combustion chamber.

At one stage the engine exhibited smoke over a wide load range at the higher speeds. This indicated inadequate mixing of fuel and air. Improved combustion was accomplished by redesigning the injector cam. This cam incorporates a "nose" that theoretically projects the travel of the plunger beyond the cup seat as shown by the cross hatched area in Fig. 2. This "nose" is an expedient to compensate for the elasticity of the injection mechanism during actual injection and to insure holding the plunger tight on its seat while relatively high firing pressures exist in the combustion chamber.

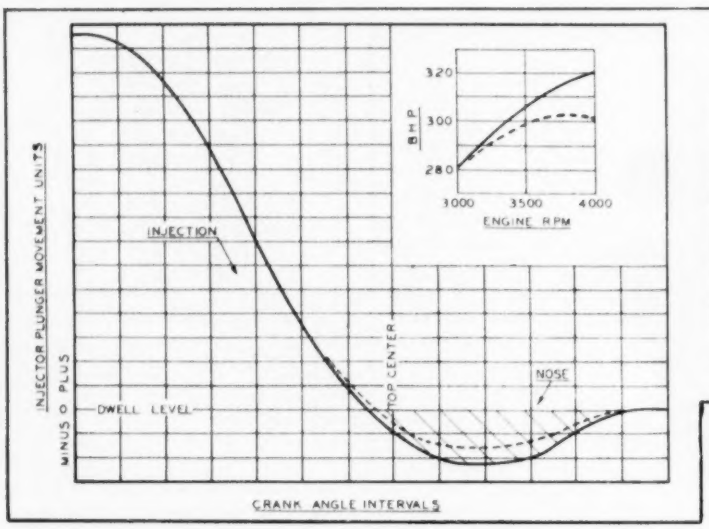
The height of the nose was further increased providing greater compensation for the elasticity of the system and a continuing high rate of injection up to the finish of injection. The benefits are illustrated and the substantial power increase at 4000 rpm. emphasizes the need for a high rate of injection up to the very instant injection ends.

The dynamic behavior of the plunger was determined by high speed motion pictures. The "knee" shown on the motion curve (Fig. 3) indicates the "solid mass" level in the injector cup. Also shown is the shifting of the actual injection timing which results from mechanical deflection. Allowance for this was made in the injection cam contour and the static timing of the engine.

During initial plunger movement, when the charge is a compressible mixture, a small quantity of fuel, and perhaps some vapor, is delivered to the combustion chamber. This is indicated in dynamic motion studies which show that the apparent "solid mass" level occurs later than in the stroke than the actual solid fuel level would indicate.

Therefore, a small pilot charge has been displaced and arrives in the combustion chamber prior to the main charge. It passes through the usual ignition delay period but has already started the fire when the main charge arrives. Thus, the condition for minimum ignition delay and fast smooth combustion of the main charge has been prepared by this initial injection characteristic.

Maximum rates of pressure rise of 100 psi. per deg. of crankshaft rotation were obtained with no undue roughness or knocking. Apparently, the injection and combustion characteristics are such that the uniformly increasing rate of pressure rise per-



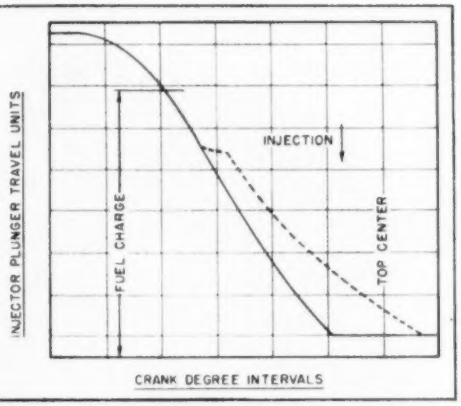


Fig. 2—(left)—A "nose" incorporated on standard injection cam theoretically projects plunger beyond cup seat (cross-hatched area—dotted line). "Nose" on JSX cam is heightened projecting plunger further (solid line). This compensates for elasticity in the actuating mechanism giving high fuel delivery rate to the end of injection. Power improvement is also indicated.

Fig. 3 (above)—Solid line is injector plunger motion measured by dial indicator with engine turned by hand. Dotted line is dynamic motion at 300 hp. and 4000 rpm. as filmed by high speed camera. Character and magnitude of elasticity is shown.

mitted exceptionally high rates with no obviously adverse effects.

The spray holes in the multiple orifice nozzle and their action have a vital effect on atomization, penetration and distribution of the fuel particles. As yet there seems to be no theoretical rule for predicting the best nozzle for an engine; trial and error is still the practical approach. Many combinations of spray holes were tried, varied as to number, size and spray angle. A reliable basis of nozzle comparison was visual observation of the exhaust color at maximum power. A clear exhaust at maximum torque requires good combustion, and therefore is indicative of a good nozzle combination.

Combustion chamber shape was determined by trial and error method, also. The method was to put metal in the chamber only where the fuel spray would not impinge. However, there were indications that fuel would carom off the piston rim and burn efficiently without smoke. Yet, this does not seem to be true as a general rule.

The final chamber (see Fig. 1) is relatively wide and flat. The piston rim-to-cylinder head clearance is large, about 5/16 inch, to avoid piston and valve interference. The volume inside the piston rim is about 69 per cent of the clearance volume.

No attempt was made to induce "swirl" in the chamber and there was little "squish" from the piston rim. Yet, the engine performed efficiently at speeds and loads well above current practices. The assumption is that the Cummins injector can distribute the fuel in the air adequately without the need of induced and controlled air movement.

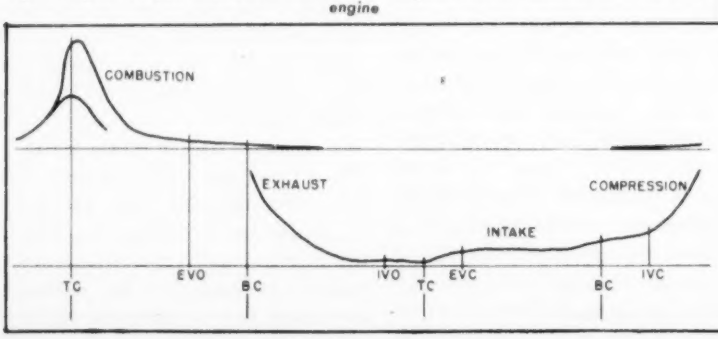
Fuel metering and distribution to the injectors was accomplished by an experimental system, under development for a long time, but which cannot be discussed in detail at this time. Its basic advantages contributed to the attainment of the flexibility and high output attained in this experimental engine.

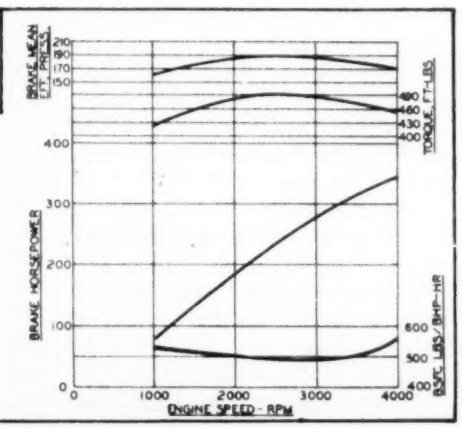
Fuels and Lubricants

Ability of the engine to digest various grade fuels was investigated. The testing range covered light fuels, including kerosene, and heavy fuels up to the equivalent of No. 4 fuel oil, with cetane ratings ranging between 35 and 55. Of all the fuels tested there was no practical difference in performance throughout the load and speed range. However, it is notable that the engine could handle such a wide range of fuels and that even the

Fig. 4 (below)—Actual cylinder pressure card representative of those obtained at high power and speed. Note rapid blow-down of exhaust gases, indication of air ramming at bottom center of intake stroke and character of pressure curve during combustion.

Fig. 5 (right)—Torque, horsepower and fuel consumption curves obtained with the JSX engine





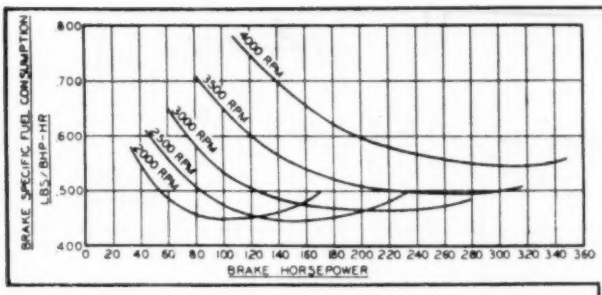


Fig. 6—Fuel consumption plotted against bhp. for different rotative speeds.

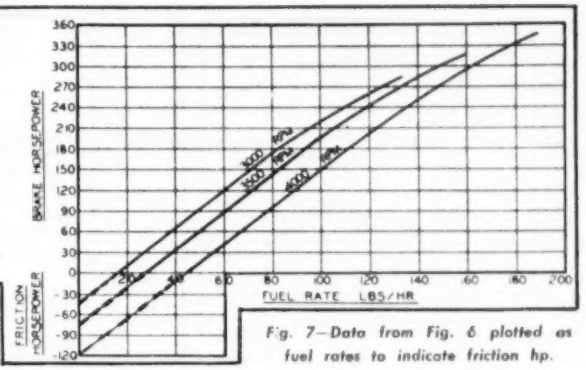


Fig. 7—Data from Fig. 6 plotted as fuel rates to indicate friction hp.

No. 4 fuel was good up to and including 4000 rpm.

Lubricating oils of various weights were tested with no appreciable difference noted. To further the interest of high flow and the attendant bearing cooling, SAE-10 commercial grade lubricating oil was used throughout the final stage of testing. The engine was equipped with an oil cooler that held the maximum oil temperature 245° F with sustained running at maximum output.

Thermal and Mechanical Efficiencies

Appraisal of the combustion efficiency of the engine can best be made in two ways. First, the condition of the exhaust at maximum power throughout the torque curve was commercially clean. Second, the fuel economy curves shown (see Fig. 5) indicate, among other things, good combustion. Minimum brake specific fuel consumption in the 2000-3500 rpm. range is remarkably good, considering that the engine was developed for best performance at 4000 rpm. and not at intermediate speeds.

At the end of the initial phase of development, 345 bhp. was pulled with a clear exhaust. This output included all accessories except the fan and generator. The rising torque curve, peaking at mid-speed range, is of the type considered good for automotive application. The engine actually ran at 172 bmep. at 4000 rpm. and increased to 188 at maximum torque. These figures were not taken at maximum possible power, but at the limit of good combustion (a commercially clean exhaust).

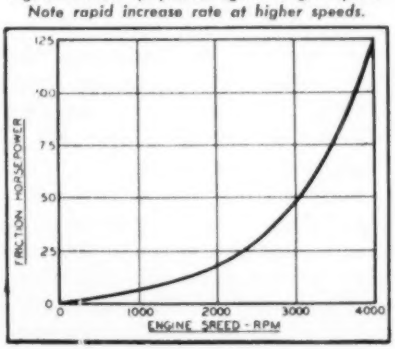
The maximum torque fuel consumption which reaches 0.490 minimum and 0.560 maximum is considered good for the size, speed and output of the engine. These rates should retain the proven fuel economy of the diesel. The over-all performance shows that wide load and speed range with accompanying flexibility can be achieved at little or no expense to engine economy.

In Fig. 6 the increase in distance between the family of speed lines reveals a normal tendency caused principally by increasing friction horsepower with increasing speed. Plotting this same data as fuel rates (see Fig. 7) and extrapolating the fuel rate lines downward to zero fuel rate gives a good approximation of the friction horsepower, at least for evaluating the effects of speed.

The curve of friction horsepower vs. rpm. (Fig. 8) suggests that windage and pumping losses are weighty factors at the higher speeds. The 120 friction hp. reached at 4000 rpm. gives a mechanical efficiency of 74 per cent. In our opinion this is on the low side for such a high specific output, but at this stage of development seems fair for 4000 rpm.

Examination of the character of the friction hp. curve leads to an interesting disclosure. The engine developed 333 bhp. at 3700 rpm. and 345 bhp. at 4000 rpm. Indicated hp. increased 35 but the friction hp. had increased 23, giving a net gain of 12 bhp. Extrapolating in this manner beyond 4000 rpm. shows that bhp. would peak at about 350 at approximately 4300 rpm. Above this rpm. the bhp. would decrease due to rapidly increasing friction hp.

Fig. 8—Friction hp. plotted against engine speed. Note rapid increase rate at higher speeds.



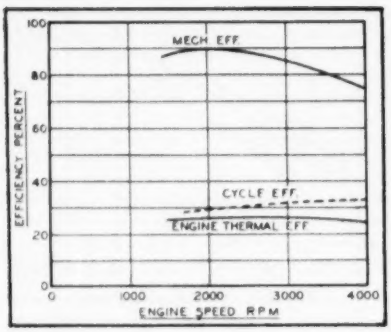
The conclusion was reached that the maximum practical rpm. of the engine was not limited by combustion, but by the rapidly increasing friction losses, principally pumping losses.

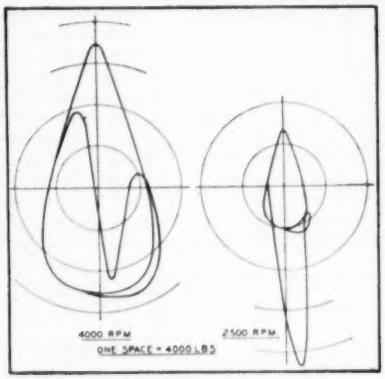
Some Problems

Heat Rejection to Water — Increased heat rejection to the cooling water at the higher speeds was anticipated; the actual increase was somewhat surprising. The minimum rate of rejection at 3000 rpm. is 40 Btu. per bhp. per min., a normal figure for diesel engines. At 4000 rpm., rejection reached a minimum rate of 80 Btu. per bhp. per min. This is a matter of concern in automotive applications because of the abnormal radiator requirements. Converting this same data to an indicated hp. basis shows the same tendency but to a lesser degree. At this stage, the "indicated" heat rejection is a major problem in need of development.

It is speculated that a large portion of the heat reached the cooling water through the exhaust passage walls. These were necessarily of aluminum and surrounded by cooling water. Exhaust temperatures at the outlets ranged upwards to 1500° F maximum. Actual temperatures must have been higher.

Intake manifold air temperature increased with speed up to 280° F at





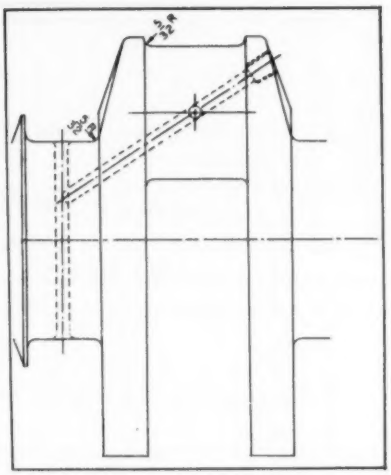


Fig. 9 (left)—Mechanical, thermal, and cycle efficiency of the JSX engine. Note that the cycle efficiency improves with speed tending to offset drop in mechanical efficiency.
Fig. 10 (center)—Comparison of connecting rod bearing loads at 2500 and 4000 rpm illustrating the effect of inertia loading.
Fig. 11 (right)—Crank elements illustrating the location of the increased fillets necessary to avoid excessive stress concentrations.

4000 rpm. This raised the mean temperature level of the whole engine thermal cycle and consequently the differential with the cooling water, promoting a higher rate of heat transfer. This, coupled with the increase in velocity and turbulence of the gases with increased speed, promoted more favorable conditions for the transfer of heat and are held accountable for the increased rate of heat rejection with increased speed.

Bearings and Bearing Loading—Since the combustion cycle of the JSX approaches the Otto cycle, high combustion pressures were expected. To reduce them as much as possible, the compression ratio was set at 14¼ to 1, the minimum dictated by starting requirements. Maximum cylinder pressures reached 1700 psi. along the torque curve compared with 1100 to 1200 psi. in our production engines.

The effect of inertia loading is shown in Fig. 10 which presents a comparison of the connecting rod bearing loads at 2500 and 4000 rpm. With a maximum cylinder pressure of 1700 psi. the maximum and mean bearing loads are higher than normal. Since centrifugal and inertia forces increase with the square of the speed, these forces predominate the bearing loading at 4000 rpm.

Main bearing loads also increased with high speed. In fact, at 4000 rpm. the engine can be classified as an "inertia loaded" engine. The bare crankshaft was balanced 100 per cent by counterweights but none of the connecting rod weight was balanced because of space limitations.

Early in the development, bearing troubles were encountered. Relief was gained principally through the cooling effect of the oil. It has been proven that the lube oil function of carrying away heat is equal in importance to lubrication. The quantity of oil required for cooling is greater than that needed for lubrication. Following this line of thought, both rod and main bearings were made with a continuous annular groove in the center of the shells. The lubricating system then circulated 30 gal. per min. at 50 psi. gallery pressure. Both the reduced projected area and lessened hydraulic load carrying ability were more than offset by the cooler running bearings. Standard production precision type copper-lead bearings were used in both mains and rods.

Torsional Vibration—Torsional vibrations in the crankshaft presented no problems after a thorough analysis of the engine. With no damper, the 4½ and 6th orders of vibration were intolerable but this was overcome by a small viscous type vibration damper at the front end of the crankshaft. While the undamped amplitudes were comparatively small, actual stresses were relatively high because of the high torsional rigidity of the crank elements. These had been designed to obtain high torsional rigidity and a high natural frequency.

Early in the development, two bending fatigue failures occurred, the cracks originating at a fillet and progressing through the web to the fillet on the opposite side. The fillet radius, one of those inescapable stress concentrations was increased from 3/32 to 5/32 in. (see Fig. 11) effecting a stress reduction of approximately 11 per cent. No further failures occurred.

Piston Pins—Piston pins presented a unique problem in the form of an epidemic of split pistons. The trouble was not recognized as pin trouble until one tear-down caught two pistons splitting upward from the pin holes instead of down from the top as had been previously concluded.

Sometimes the pin would split the rod rather than the piston depending on which imposed the most restraint on the pin. The hollow pin was flattening, as revealed by test, under the tremendous loads imposed on the pin bosses or rod eye. Increasing the wall thickness reduced the deflection without too large an increase in pin weight.

Further benefits were gained because deflections at the piston ring belt were reduced, decreasing blow-by and run-in time because of more favorable conditions for ring seating. The pins also showed another characteristic, unexplored and not satisfactorily explained, wherein they were vibrating axially and battering the locating snap rings and their retaining grooves.

Piston Rings—The original engine was set up with three standard SAE section 5/32-in. wide keystone compression rings and one oil control ring. Performance was completely unsatisfactory. At high speed, apparently the ring inertia overcame the gas pressure,

(Continued on Page 75)

Washington Slant

NEW PIPELINE OUTLOOK is not so good, at least in the East. Petroleum Administration for Defense has drafted tentative nation-wide order limiting use of gas in States east of the Mississippi. Says that steel shortage will prevent completion of essential pipelines. To protect current users, tentative order will bar any new space heating or large volume customers. Elsewhere, construction will continue within limits of CMP allotments.

APPLICATIONS FOR PIPELINE RIGHTS-OF-WAY, across public lands now pending or in the future will be required to include a stipulation which would "Give force and effect to the common carrier requirements of the 1920 Mineral Leasing Act." Idea is for them to act as common carriers and not monopolies to insure "a just and reasonable element of competition" to protect the public interest.

TIN USE RISES 13 per cent while stocks declined in the first quarter of 1951 according to NPA study. Comparison is with similar period in 1950. Major increases were seen in bronze, solder and babbitts, all essential in the production of engines. Rise for this use was probably higher but was partially offset by decline in tinplate and terneplate.

AMENDMENT TO DIRECTIVE 3, CMP REG. 1 is intended to relieve small users from difficulties in placing orders for controlled materials. Manufacturer with quarterly or advance allotment equal to or more than a carload lot, may order the full carload despite the fact that such amount may exceed the total permitted ordered in one month under Direction 3. Also, manufacturer may order up to 50 per cent of his advance quarterly allotment of controlled materials for delivery in any one month for which the allotment is valid.

AMENDMENT, CMP REG. 5 deals with MRO and limits orders for and receipts of such materials in the first month of any quarter. Maximum is 40 per cent of quarterly quota. Also, Item 10, Schedule I (rails, tie plates, track spiles, splice bars, rail joints, frogs, and switches) is deleted.

REPORTED SHORTAGE OF TRACTOR PARTS caused NPA to investigate. Report comes both from the Military and civilian users. Major items are not for engine but are track parts. Sharp demand, principally due to rearmament program, was determined to be major factor with the result that available machines are being worked at better than double normal operating periods. Builders are diverting large proportions of materials and facilities to parts production sometimes at the expense of new machine production. NPA is considering help through spot assistance to those making parts.

MACHINE TOOL INDUSTRY, after long kicking around is finally getting attention. Charles E. Wilson, has stated that vigorous steps are being taken to break the machine tool bottleneck. Earlier Industry Committee Meeting brought out that required expansion would necessitate one or more of the following: (a) Super-priorities for materials, facilities and tools (b) more skilled labor and; (c) adequate financing. A new order revising the price structure of the industry was issued about Sept. 1, and steps are being taken to ease the man power situation. In spite of difficulties, some reports indicate that production has been tripled in the last 14 months.

INTERNAL COMBUSTION ENGINE INDUSTRY ADVISORY COMMITTEE was told by NPA that production of certain engines will be placed on a unit scheduling basis in the fourth quarter of 1951. Generally, unit production will be authorized to the largest number that can be built with authorized CMP allotments.

COPPER STRIKE IS BLOW to defense and defense supporting production. Estimated that the strike at the Garfield, Utah, plant of the American Smelting & Refining Co. brought a loss averaging over 10,000 tons per month. The President authorized release, on loan basis, of up to 25,000 tons from national stockpile to keep the wheels turning.

FOURTH QUARTER 1951 ALLOTMENTS for controlled materials have been set and some of the major programs of interest are listed along with the amounts allotted:

Division	*Total Steel (tons)*	*Total Copper & Copper Alloys (000 lb.)*	*Total Aluminum (000 lb.)*
Engine & Turbine	461,600	15,070	2,600
General Components	1,067,500	150,094	14,700
Motor Vehicle	3,464,300	147,800	92,300
Railroad Equipment	1,872,475	64,355	8,500

NICKEL SHOULD BE TIED IN TO CONTROLLED MATERIALS in the opinion of industry spokesmen. They want to know in advance what amounts of nickel may be expected along with controlled materials so as to plan accordingly. A lead time of from three to five months, depending on shape and form of nickel needed, is deemed desirable.

Dual-Fuel Engine Cuts Fuel Bill for Colby, Kansas Municipal Plant

A YEARLY saving of $19,000 in the cost of fuel for electric power production has been made possible at the Colby, Kansas municipal power plant, by the installation of a Fairbanks-Morse 1118-hp. dual-fuel engine. To accomplish this saving, the unit has been in operation more than 96 per cent of the time and has generated more than 83 per cent of the total plant output at a fuel cost of 3.7 mills per kwh.

Colby was first supplied with electric power in 1910, by a small steam plant. Two 100-hp. diesels were installed in 1921, followed by a 600-hp. in 1925.

The plant's period of modern expansion and improvement began in 1947 with the installation of a 1200-hp., 4-cycle, supercharged, Alco diesel. This engine, while a distinct improvement over the older engines, was still dependent on expensive fuel oil.

In June, 1949 a solution of the expensive fuel problem (Colby is currently paying 10.1733 cents a gallon for fuel oil) was found in a Fairbanks-Morse 7-cyl., 16- by 20-in., 2-cycle pump scavenging, dual fuel engine. This unit has a normal rating at sea level of 1400 hp. at 300 rpm., but was slowed to 257 rpm. to meet the city's preference for a slow speed engine. At this speed and the city's 3120-ft. altitude, this engine is rated at 1118 hp. Fuel is natural gas (which costs Colby 21.1 cents per 1000 cu. ft.) and a small quantity of pilot oil.

In 1950 the dual-fuel engine ran 8442 hours out of a possible 8760 or 96.37 per cent of the time. Power generated during this time was 3,755,000 kwh., or 83.21 per cent of the total power generated at the plant. Fuel consumed was 52,025 mcf. of natural gas at a cost of $10,977.39 and 29,547 gal. of fuel oil at a cost of $3,005.91 giving a total fuel cost of 3.71 mills per kwh.

Fuel cost of the oil burning engines averaged 10.54 mills per kwh. for the year, which meant a saving of 6.83 mills per kwh. for the dual-fuel engine. At this rate the yearly savings amounts to $25,721.78. This is not a wholly fair comparison since the diesels carried less economical loads than they would have if they had handled full plant production.

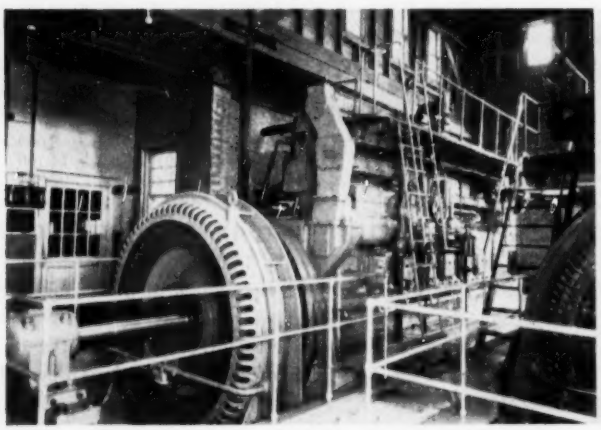
A better comparison would use diesel fuel efficiency for 1947, a year in which the oil engines carried the entire load, and actual oil prices in 1950. By this standard, the diesels produced a kwh. for 9.262 mills. The dual-fuel engine's 3.713 mills per kwh. thus meant a saving of 5.549 mills, a 60 per cent cut.

If, during 1950, all power had been generated by diesels at a fuel cost of 9.262 mills per kwh., the city's fuel bill would have been $41,921.66. Actually, with the dual-fuel unit producing at 3.71 mills per kwh., the total fuel cost was $21,999.56. Clearly, the city made a saving of $19,922.10 by reason of having this one dual-fuel engine in operation for the year. If Colby had the gas engine capacity to produce all power at the dual-fuel rate of 3.7 mills, the savings would have been $25,115.88.

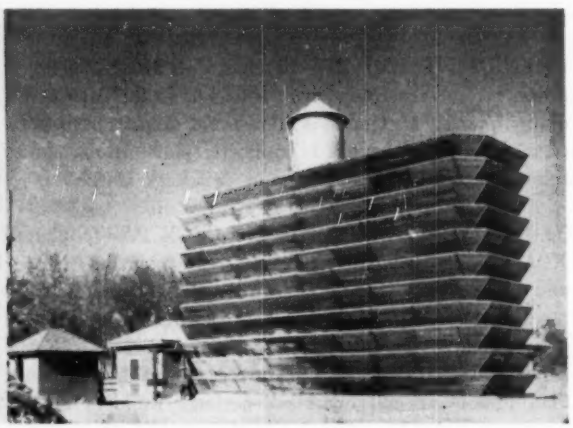
Even this gratifying figure does not represent the engine's full potential for savings. The load varies from as low as 300 kw. after midnight to a peak of 1120 kw. Since the dual-fuel is the most economical unit, it is run even when the load is unfavorable. The average load for the year cited was just 60 per cent of engine rating. However, due to increasing power demands in the area, the engine will operate at greater efficiency as the load rises.

The natural gas used has a heating value of 960 Btu. per cu. ft. The gas reaches the plant at 50 psi., is reduced to 30.5 psi. and metered and then piped to the throttle valve on the engine. The quantity of gas admitted to the cylinders is controlled by the governor to meet the load variations. Special small volume fuel pumps send

This Fairbanks-Morse 1118 hp. dual fuel engine is producing power at 4 mills per kwh.



Pritchard cooling tower; which incorporates four Griscom-Russell tube sections, serves all engines at the plant.



a constant, accurately-metered charge of pilot oil to initiate combustion. In the event gas pressure fails, the engine automatically switches over to oil and utilizes the regular diesel fuel injection pumps. A diesel fuel of 34-36 gravity is used for pilot oil and for the oil-burning engines. It is stored in three underground tanks, transferred by motor driven pumps to elevated day tanks in the engine room, and piped by gravity through individual meters to the engines.

Lubricating oil used in the dual-fuel engine is of the detergent type for both cylinder lubricators and crankcase. Lube oil is circulated by an engine-driven pump to all the bearings and then up to cool the pistons. In this circuit is a full-flow oil strainer and a shell and tube cooler. Part of the oil is drawn from the pressure side of the circulating pump to a cellulose filter and returned to the crankcase. Scraper ring oil is also put through the filter and returned to the sump. A motor-driven pump is used to bring up oil pressure before starting the engine and after shutting down.

Condition of the oil is checked regularly with a dilution indicator of the falling-ball type and shows no dilution whatsoever. Inspections show the engine to be as clean as it was when first put into service. Lube oil consumption has been low with the engine operating better than 5000 hp. hr. per gal. of lube oil consumed.

Climatic conditions of the Kansas area introduce problems in the design of a cooling system. There are strong winds and in winter lots of ice. Available water is hard and the plant must contend with both algy and scale. The system used in this installation is a closed cooling system in which the basic unit is an atmospheric tower incorporating four 20-ft. tube sections with 83 tubes per section. Three motor-driven centrifugal pumps circulate water through the engine jackets and the tower tubes. Any one or combination of pumps can be run and two pumps are required to handle three engines.

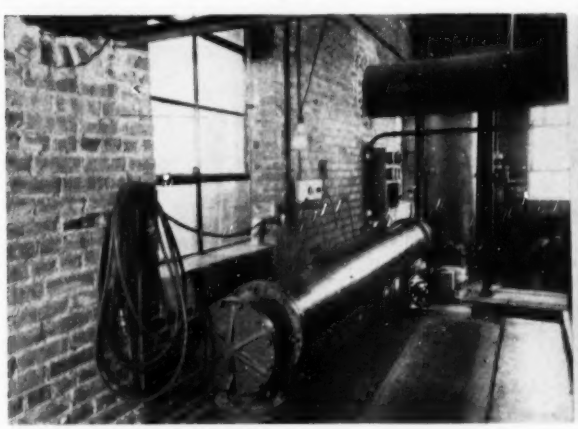
On the raw water circuit there are three motor-driven centrifugal pumps, each with a different function. One pump handles two sections of the tower, one handles the other two sections and the third feeds spray just above the tubes. Thus, any one or combination of pumps may be used, providing a wide range of cooling. In an effort to avoid scale, a large volume of water is used rather than a spray. In the soft water jacket circuit, very little make-up is required and the operators have not had to clean the engine jackets in 10 years.

Scavenging air for the dual-fuel engine is drawn through a set of four oil-bath filters into a plenum tank to dampen pulsations. Exhaust gases exit through a vertical snubber outside the building. A compact gauge and alarm panel for the gas engine holds an exhaust pyrometer and pressure gauges on fuel and lube oils. Starting air is supplied by two motor-driven compressors controlled automatically to keep the air tanks at 290 psi.

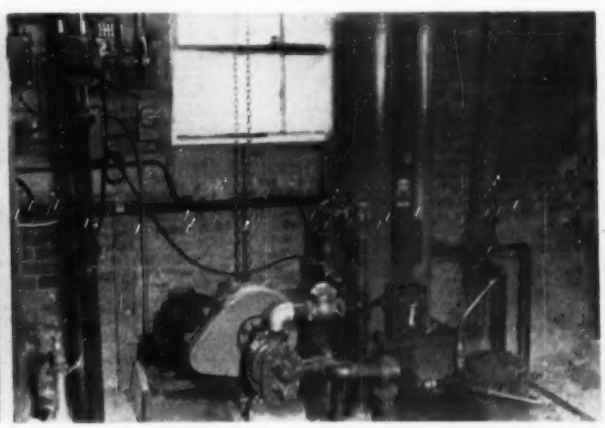
Principle Equipment Listing on F-M 1118 hp. Dual-Fuel Engine for Colby, Kansas Municipal Power Plant

Engine	One 1118-hp., 7-cylinder, 16 X 20 in., Model 33FD16 dual-fuel engine operating at 257 r.p.m. Fairbanks, Morse & Co.
Generator	One 780 kw., 2400 volt, 3-phase, 60 cycle alternator with V-belted exciter. Fairbanks, Morse & Co.
Governor	Woodward Governor Co.
Pilot Oil	34-36 gravity oil. Shallow Water Refining Co.
Pilot oil meters	National
Gas	Kansas-Nebraska Natural Gas Co.
Gas meter	Metric Metal Works
Fuel filters	W. W. Nugent & Co., Inc.
Lube oil	Standard HD 30. Standard Oil Co. (Indiana)
Lube oil pump	Geo. D. Roper Corp.
Lube oil strainer	Purolator Products, Inc.
Lube oil cooler	Ross Heater & Mfg. Co. Inc.
Lube oil filter	Honan-Crane Corp.
Cylinder lubricators	Madison-Kipp Corp.
Dilution indicator	Gerin Corp.
Cooling tower	J. F. Pritchard & Co.
Cooling tower tube sections	Griscom-Russell
Cooling water pumps	Two Peerless One Dayton-Dowd
Raw water pumps	Two Worthington One Dayton-Dowd
Air filters	Four Air-Maze Corp.
Exhaust snubber	Burgess-Manning Co.

Lubricating oil for the dual-fuel engine is circulated through this Ross oil cooler.



A Honan-Crane oil purifier operates continuously on the engine's lube oil. Auxiliary lube pump is at left.



Diesel Equipment Flown to Canadian Iron Ore Fields

NEWEST twist in railroad construction on the newest major railroad in North America is taking place in Canada this summer, where airplanes engaged in the world's largest "civilian airlift" are supporting the construction of the new Quebec, North Shore, and Labrador Railway.

This new line will serve the fabulously rich iron ore deposits in northern Quebec and western Labrador. With U. S. sources and reserves of top-grade iron dwindling at a rapid rate, the pressure of defense production demand for this essential mineral makes every day count in the development and exploitation of the hitherto practically inaccessible mines of the Iron Ore Company of Canada.

When completed in 1954, the railway will extend 350 miles from the St. Lawrence River port of Seven Islands, Quebec, through the desolate northern wasteland to Knob Lake, Labrador, site of the mines. Tonnage of ten million long tons annually is anticipated by railroad officials, but construction, yard and terminal facilities are being provided for double that capacity.

Today, all supplies and equipment come by boat to Seven Islands. There the "airlift" takes over to supply the center area of construction at Wacouna (Mile 97) and the end of the line at Knob Lake. A "flying boxcar", a Fairchild C-119 (on loan from the U. S. Air Force "in the interests of national security"), has already carried in fifteen big red International TD-14A tractors to Knob Lake. The tractors are shipped complete, minus only their track pads and drawbars and are driven on and off the plane under their own power. The tractors will be used in camp site construction, dam building and mine operations as well as in the building of the railroad.

Large earth-moving scrapers of 8 cu. yd. capacity are also carried without dismantling—with one inch to spare on either side.

One TD-14-A tractor or one scraper constitutes a full load for the aircraft which hauls 16,000 lbs. pay-load at a speed of 200 mph. The box-car has made as many as three round trips daily with full loads each time.

The summit of the railway is reached at Mile 150.8 at 2056 ft. The maximum adverse grade which southbound loaded trains will encounter is 0.3 per cent. Maximum adverse grade for northbound empty ore trains is 1.8 per cent.

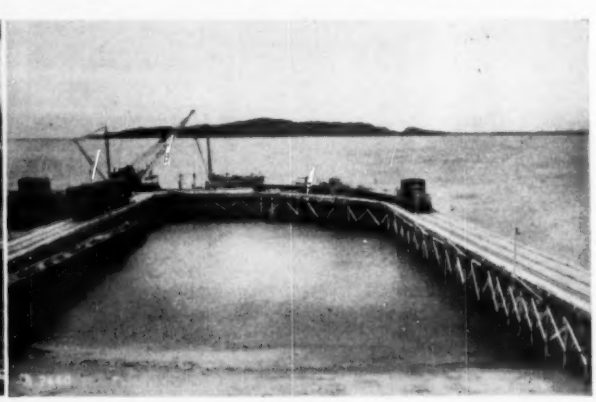
The only tunnel required will be at Mile 11.5. It will be 2250 ft. long and is now under construction. Two major bridges will be needed—one 680-ft. long across the Moisie River at Mile 12, just north of the tunnel, and another at Mile 328 across the Hamilton River.

The railroad will have 357 miles of

Left — Map showing the location of the fabulously rich iron ore mines.

Lower left — Railroad construction crews are supplied through airstrip at Wacouna.

Lower right—Temporary wharf at Pointe au Basque yards will grow to 20 million tons a year ore docks.



main line, all single track of 132-lb. rail. Passing tracks will be located every thirty miles and will be radio controlled.

At 1954 capacity, the railroad is expected to haul about 50,000 tons of iron ore daily in five trainloads of about 10,000 tons each. All motive power will be diesel-electric, four 1600-hp. diesel-electric units pulling a train of one hundred ore cars of 112 net ton capacity.

Ore docks and freight yards at Seven Islands are being constructed to handle double the first year's planned tonnage, according to J. C. Martin, assistant to the chief engineer of the road. Receiving and ore-grading yards will be part of the installation. At Knob Lake, the marshalling yard will have spurs to the main line hoppers. However, the spurs will not enter the mine pits (as was the case in Minnesota's huge Mahoning pit at Mesabi). Instead, scoop shovels taking eight cubic yards at a bite will load into 30-yd. capacity trucks for the haul to trackside, mine officials plan.

Hydro-electric power will be developed at two dams to supply power to the mines, railroad, townsites and terminals. Scheduled for first construction is a dam at the rapids on Lake Menihek, which will be of the earth-fill type and will act as a bridge for the railroad. Generating capacity of the power plant at this dam will be 30,000 hp., scheduled for delivery in 1953. This dam will be located some thirty miles south of the end-of-track at Knob Lake and will supply all power for the Terminal at Knob Lake.

The other dam will be constructed on the Marguerite River, about 15 miles west of Seven Islands. This dam will also develop about 30,000 hp., supplying electric power to the ore docks and the rail terminal on the St. Lawrence.

Electric power for Iron Ore Company of Canada's remote Burnt Creek camp, located at the rich new iron discoveries in the wasteland of northern Quebec and western Labrador, is now being supplied by an International UD-24 180-hp. diesel engine and an 85-kw. Ready Power generator set, part of the earliest cargo flown in by the "airlift" supplying the mine development.

Two smaller generators are also on hand at Burnt Creek, an International UD-6 diesel engine and 20-kw. generator and a Caterpillar D-4600 diesel with a generator of similar capacity. These units will supply power for the welding machines to be installed in the camp's maintenance shops and to act as standby power.

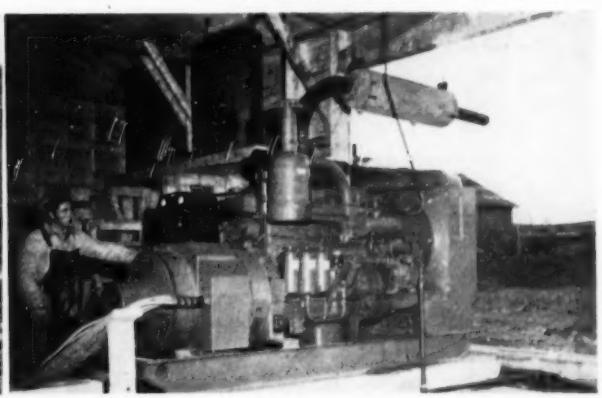
Once the dam is completed, it will provide power for the mining operations and all other facilities in the Burnt Creek area. The generator sets will then become standby units.

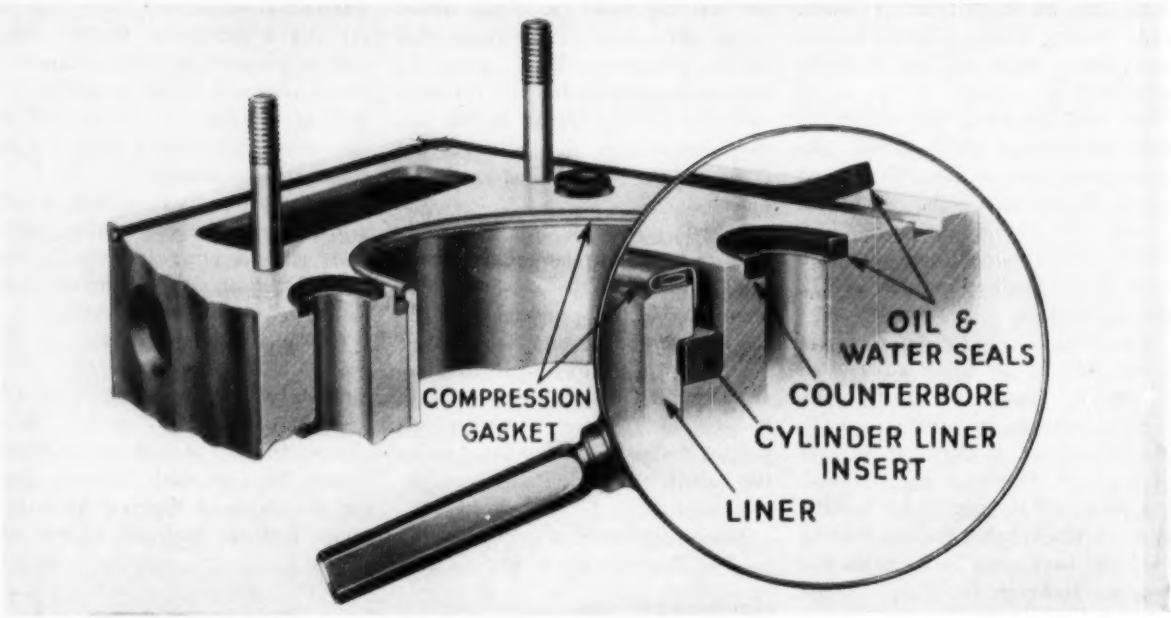
Operations of the mines are expected to be practical from May through October, and the railroad will operate at capacity during those months. Ore will be stockpiled at Seven Islands for continued shipments during the period of the year when the mines and the railroad cannot operate.

Tractor is driven aboard flying boxcar under its own power. Note, track pads have been removed.

Tractor and scraper (flown in on separate flights) work on roadbed of new railroad.

During construction of power dams electric lights are supplied by this 85 kw. diesel-generator set.





GM Series 71 Engine Improvements

Specific Alterations Have Been Made in

- *Head to Block Sealing with Improved Gasket System.*
- *Valve Seat Angle and Liner Flange Seat.*
- *Camshaft Timing of Vehicular Engines.*
- *Governing Lower Speed Range of Vehicular Engines.*

SEVERAL improvements designed to prolong engine life and further reduce upkeep of General Motors Series 71 diesels have been incorporated by Detroit Diesel Engine Division in their latest models.

Chief among these newly designed features is a method of oil, water and compression sealing between the engine block and head which does away with the laminated gasket commonly used in internal combustion engines.

The most difficult task of cylinder head-to-block gasketing is compression sealing. Oil and water passages must also be perfectly sealed, of course, to prevent the dilution of crankcase oil. Detroit Diesel, through the adoption of individual seals designed to place primary emphasis upon compression sealing and secondary but sufficient emphasis on sealing the oil and water passages, has accomplished both in a new way. Because no over-all or one-piece gasket is used, the new system is called the "metal-to-metal" head and block.

Compression gaskets, in the form of laminated Terne Plate (sheet iron coated with an alloy of lead and tin) rings, take the major pressure of the head-to-block stud bolts. A small "skirt" on each compression gasket ring fits into a recess between the cylinder liner and the cylinder bore in the block, assuring correct positioning over the cylinder liner.

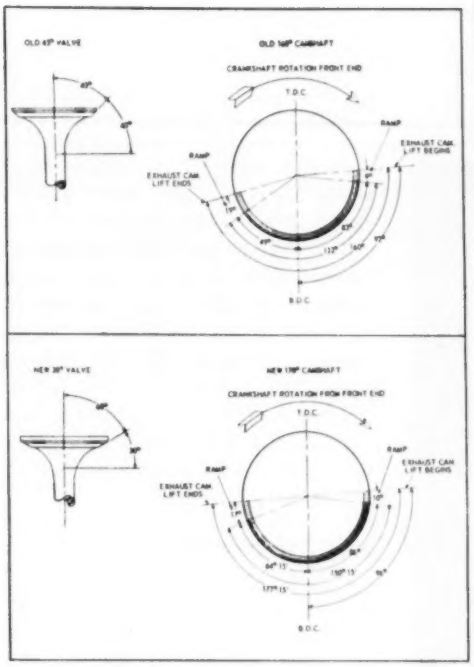
When the head is pulled down a positive metal-to-metal contact is assured between the lower surface of the head, the compression gaskets and the cylinder liners. Immediately adjacent to the compression gaskets, however, there are clearances between the head and block of from 0.007 to 0.014 in. This assures positive contact on the compression gaskets and positive compression sealing.

Water and oil passages between head and block are sealed with individual synthetic rubber seals that look like hose washers. These seals fit into grooves machined in the block and are compressed when the head is bolted on, forming a very effective sealing device.

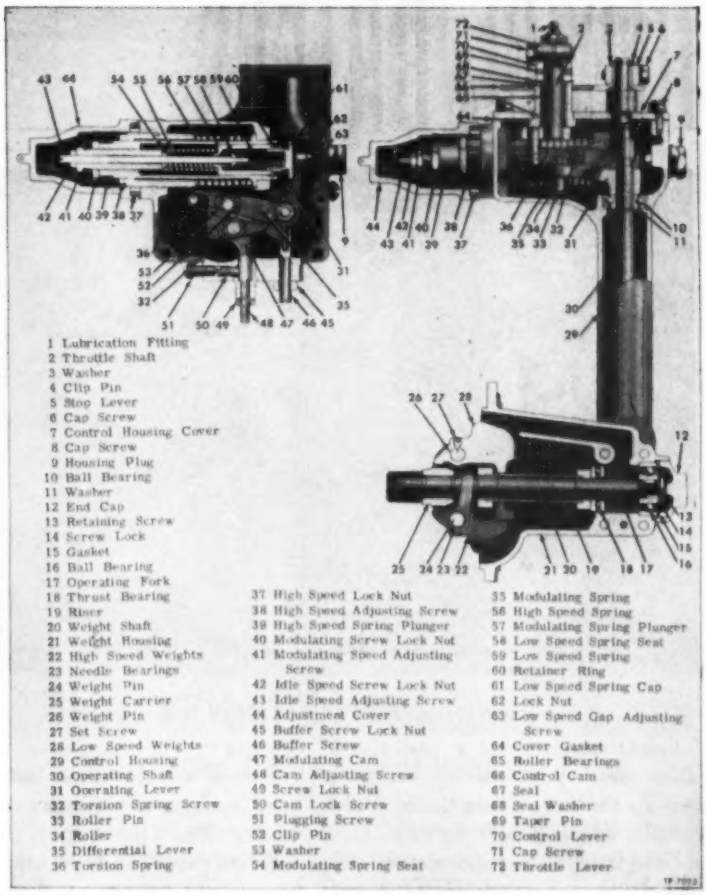
Installation of these seals, both at the factory and in the field, is simply a matter of dropping the proper size seal in the counter-bores. The circular seals come in only two sizes, sufficiently different to be immediately recognizable. Two "figure eight" seals are used to seal a pair of adjacent water-and-oil passage holes at each end of the engine.

A long, endless seal of approximately the same cross-section as the "washer" type seals, fits in a rectangularly-milled groove approximately 5/16 in. in from the outside perimeter of the block. This is called the "oil" seal as it replaces an interlocking 4-piece "oil gasket" formerly used in this location, sealing off the camshaft cavities from the outside of the engine.

This change in head-to-block sealing method is the most fundamental design change which has ever been made in the Series 71 engine. Detroit Diesel engineers believe that the new method will be superior to any other gasketing method. Its development depended



At top is the original valve seat angle and timing diagram. Below is the new seat angle for all models and the timing diagram for vehicular engines (only) with the new camshaft.



1 Lubrication Fitting
2 Throttle Shaft
3 Washer
4 Clip Pin
5 Stop Lever
6 Cap Screw
7 Control Housing Cover
8 Cap Screw
9 Housing Plug
10 Ball Bearing
11 Washer
12 End Cap
13 Retaining Screw
14 Screw Lock
15 Gasket
16 Ball Bearing
17 Operating Fork
18 Thrust Bearing
19 Riser
20 Weight Shaft
21 Weight Housing
22 High Speed Weights
23 Needle Bearings
24 Weight Pin
25 Weight Carrier
26 Weight Pin
27 Set Screw
28 Low Speed Weights
29 Control Housing
30 Operating Shaft
31 Operating Lever
32 Torsion Spring Screw
33 Roller Pin
34 Roller
35 Differential Lever
36 Torsion Spring
37 High Speed Lock Nut
38 High Speed Adjusting Screw
39 High Speed Spring Plunger
40 Modulating Screw Lock Nut
41 Modulating Speed Adjusting Screw
42 Idle Speed Screw Lock Nut
43 Idle Speed Adjusting Screw
44 Adjustment Cover
45 Buffer Screw Lock Nut
46 Buffer Screw
47 Modulating Cam
48 Cam Adjusting Screw
49 Screw Lock Nut
50 Cam Lock Screw
51 Plugging Screw
52 Clip Pin
53 Washer
54 Modulating Spring Seat
55 Modulating Spring
56 High Speed Spring
57 Modulating Spring Plunger
58 Low Speed Spring Seat
59 Low Speed Spring
60 Retainer Ring
61 Low Speed Spring Cap
62 Lock Nut
63 Low Speed Gap Adjusting Screw
64 Cover Gasket
65 Roller Bearings
66 Control Cam
67 Seal
68 Seal Washer
69 Taper Pin
70 Control Lever
71 Cap Screw
72 Throttle Lever

Right—Sectionalized view and nomenclature of governor with new fuel modulator for vehicular application.

upon the design of the spring-like compressible compression gaskets and the fairly recent availability of synthetic rubber which will take the heat of such an application and also be impervious to oil.

The new Series 71 engine blocks are manufactured 1/16 in. higher to make up for the difference between the old laminated gasket and the new sealing system. Since other component parts and the crankshaft-to-cylinder-head distance is not changed, the compression ratio is not affected.

Both the head and the block have been materially strengthened. Additional internal ribs were added to the head and existing ribs and struts in the block were "beefed up". Longer cylinder-head studs with more thread contact are used.

A second new feature in the Series 71 engine design is a special chilled-and-tempered cast iron ring which now forms a replaceable seat for the cylinder liner upper flange. One of these is dropped into the counterbore of each cylinder before the cylinder liner is inserted, effectively prolonging cylinder liner life.

In the new production engines the angle of the exhaust valve face and the valve seat inserts has been changed from 45 deg. to 30 deg. to reduce the turbulence of escaping exhaust gases and scavenging air. Experimentation demonstrated that "freer breathing" in the engine and longer valve life would result from lessening the exhaust angle.

Other new design features include roll-burnished crankshaft fillets and peened oil holes in the Tocco-hardened crankshaft. Re-design of the block also enabled Detroit Diesel engineers to improve the retention of intermediate camshaft bearings by installing longer retaining screws.

The improvements are incorporated in current production models of 3-, 4-, and 6-cyl. single Series GM diesels and multiple-engine units ranging from 51 to 800 bhp.

GM's Truck and Coach Division also announced its "Million Miler" engine, incorporating the same basic engine, but with some new features applicable only to vehicular usage.

Horsepower of the 4-71 has been increased from 133 to 150 hp. and the 6-71 has been raised to 225 hp.

Although power has been increased, good fuel economy has been effected by a new device known as a "fuel modulator". This is an automatic control that feeds exactly the right amount of fuel and air for the maximum efficiency *regardless of the throttle position.* It exerts its maximum effect at engine speeds below 1500 rpm., the point where, heretofore, a driver could "lug" the engine and waste fuel.

Another feature of the vehicular version of this engine is a new camshaft that keeps valves open longer to improve scavenging at the higher rotative speeds. Thus, the fuel modulator saves fuel at the lower speed range while at engine speeds over 1500 rpm. fuel economy has been increased 6 per cent by incorporation of the new 170° camshaft.

DIESEL BRIEFS

Additional Power for Nevada Plant

Recent purchase of a new Caterpillar diesel D397 electric set (314 kw.) by the Wells Power Co. of Wells, Nevada, will double its capacity.

Four Caterpillar diesel electric sets (the D397, and three D17000s) and a gasoline engine now produce power for the company in town, while approximately one third of the company's output comes from a hydro plant eight miles west of Wells.

Demand for electricity in the area has doubled in the last five years, and in addition the company has signed a contract to furnish power for Bell Telephone and Telegraph installations being made in television towers under construction in the vicinity.

Future expansion plans for the company embrace another hydro installation but due to the present national emergency situation promising additional material shortages, and high costs, the project may be delayed for some time. Meanwhile, with the new diesel electric addition, the community is insured of enough capacity to meet its demands during the emergency.

Diesel Engine Operators Conference

A Diesel Engine Operators Conference will be held on the campus of The Oklahoma Agricultural and Mechanical College at Stillwater, October 22-25. The object of the conference is directed primarily toward the operators of large low and medium speed diesel and dual-fuel engines. Information to be covered includes maintenance and servicing of lubricating systems, fuel systems, electrical equipment, blowers and superchargers and governors. Also there will be information on high temperature coolant operation and plant safety.

The attendance is not limited, the registration fee being $10.00. Registration may be made through Professor M. L. Powers, Engineering Extension Division, Oklahoma A & M College, Stillwater, Oklahoma.

Secret British Engine

A secret new airplane power plant —combining a diesel piston engine with a gas turbine—is about ready for flight testing, the English Napier Aero Engine Company disclosed recently.

If successful, it would have two big advantages—the use of economical diesel fuel, and a low fuel consumption that would allow either bigger payloads or longer flight range for both civil and military planes.

So far there is no indication it would produce the high aircraft speeds of pure jet engines.

The engine has been designed to produce 3000 hp. to turn two contra-rotating propellers—one turned by the diesel engine, the other by the gas turbine operating off the exhaust gases. The diesel is a highly supercharged engine, and the turbine does not need the static combustion chambers used to burn gases in normal jet and gas-turbine engines.

New Locomotives

Class I railroads had 1602 new locomotives on order on August 1, 1951, the Association of American Railroads announced recently. On the same day last year there were 1132 on order.

Of the total number awaiting delivery on August 1 this year, diesels totaled 1588. In addition, there were 12 steam and 2 electric locomotives on order.

Installation of new locomotives in the first seven months of 1951 totaled 1483, of which 1471 were diesel, 10 steam and 2 electric. Installations in the same period in 1950 totaled 1289, of which 1283 were diesel and 6 steam.

In July this year, Class I railroads installed 174 new locomotives, all of which were diesels except for 2 steam locomotives.

Petroleum Mechanical Engineering Conference

The American Society of Mechanical Engineers is holding its sixth annual Petroleum Mechanical Engineering Conference at the Mayo Hotel, Tulsa, Oklahoma on September 24th through 26th. The theme is conservation of manpower and materials.

Of special interest to those in the internal-combustion engine field are two sessions. On Tuesday, September 25th at 2.00 p.m. there is a session on pipeline engines, and on Wednesday the 26th at 9.00 a.m. a session on operations, including a paper on "Conversion of Existing Diesel Engines to Dual Fuel".

DIESEL BRIEFS

Registration for the Conference starts Sunday the 23rd at 3 pm. A fee of $2.00 for ASME members and $3.00 for non-members will be made for which available preprints of the technical papers will be furnished.

SAE Tractor Meeting

Thorough study of present and prospective engineering requirements in the fields of tractors, farm-implements, and earth-moving equipment was made at the National Tractor Meeting and Production Forum held by the Society of Automotive Engineers at Milwaukee, September 10 through 13. The meeting was sponsored jointly by the SAE Tractor and Farm Machinery and Production Activities.

The first day was devoted to a production forum, with round table discussions covering gears, materials handling, quality control, welding, heat treating, forging and foundry. The following days were devoted to technical papers, covering not only farm and commercial needs for tractors and other heavy equipment, but also the requirements of the military. Also covered were foreign equipment, effects of rim width on tire performance, tractor ride research, torque-measuring apparatus, and performance characteristics.

KW Output at Record High

Impact of the defense and defense stimulated activity on the country's electric power resources was emphasized recently in a report by the Federal Power Commission. It was revealed that production of electric energy in the year ending June 30, 1951 had reached a record level of 350 billion kwh., surpassing the previous year by over 47 billion.

The effect of the defense effort is reflected in a three year expansion program outlined by the Defense Electric Power Administration (DEPA) as essential to power our expanding economy. According to DEPA, an increase of 27 million kw. of new generating capacity during 1951-53 will about do the job. There is also at the present time a precariously low margin of reserve power now being maintained—about 5 per cent.

Looking at the power situation from another angle, we find that the nation's power consumption has been increasing at the rate of 6 per cent annually for the past several years. Over the next three years, however, it is expected to grow at the rate of 12 per cent.

The greatest single factor in keeping the power program on schedule is the availability of materials. DEPA officials estimated 1951 third quarter requirements of utilities and power equipment manufacturers at roughly 10 per cent of the nation's aluminum, 14 per cent of its copper, and 3 per cent of its steel. Allocations actually made fell far short of these figures.

Repowered Shovel Speeds Loading

Replacing a gasoline engine with a diesel in this 2½ yd. P & H shovel has increased output over 100 per cent. Working in the iron ore pits of the Lone Star Steel Co. at Daingerfield, Texas, the company recently installed a 300 hp. Model NHRIS-600 Cummins diesel driving through a hydraulic torque converter in the shovel. A 16-ton dump truck is now loaded with unblasted iron ore in 1½ to 2 min. as compared to 3½ to 4 min. under its previous gasoline engine power. The Euclid 16-ton rear dump trucks are powered with 150-hp. Model HBID-600 Cummins diesel engines.

Alloying Agents Found in Alaska

Of the 33 metals now classified as strategic and critical materials subject to stockpiling, 31 are known to occur in Alaska. Many of these materials are necessary in engine production as well as a host of other things.

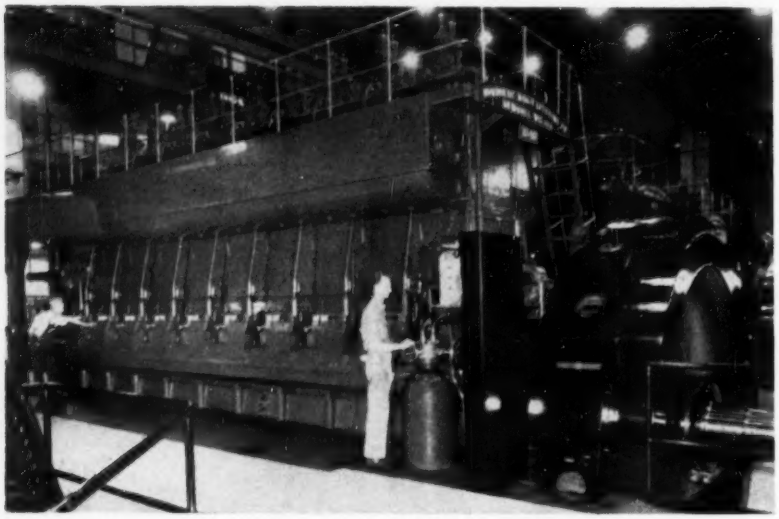
Of known domestic occurrences of tin and high-grade chromite, the most promising are in Alaska. Our major source of platinum is also here. In addition there are deposits of copper, lead, mercury, zinc, antimony, titanium, molybdenum, graphite, iron, and tungsten.

Petroleum is another untapped resource in Alaska. In 1923 President Harding created the 35,000 sq. mi. Naval Petroleum Reserve, the world's largest oil claim, near Barrow, above the Arctic Circle.

Ponca City Reports

Fuel Bill Cut with Gas Diesel

by Mr. Pat Schlesinger
Superintendent, Ponca City Water and Light Department



Nordberg 3600 hp. Duafuel engine was in operation 96.4 per cent of the time and produced power for a total cost of 1.62 mills per kwh.

PONCA CITY, Oklahoma, has had an impressive record of economical power production ever since 1926 when a heavy, low-cost fuel oil was introduced for consumption in the air-injection Nordberg diesels. With oil prices rising steadily after the end of World War II, this was one of the first plants to turn to low cost natural gas, putting into service on January 5, 1947 a 2400-hp. Nordberg Duafuel diesel engine which burns gas with a small quantity of pilot oil. Next, the 2250-hp. diesel, which had been in service since 1937, was converted and began burning gas on December 10, 1947. Finally, a new 3600-hp. Nordberg Duafuel diesel engine was put on the line May 19, 1949, bringing total plant capacity to 12,000 hp., of which gas engines made up 8250 hp. In the fiscal year ending June 20, 1950, these three Duafuel units generated 25,811,200 kwh. at a total fuel cost of just 1.62 mills per kwh.

The effect of introducing succeeding Duafuel engines can be seen in the production and cost record from 1947 through 1950. In 1947, the gas units generated 2,590,000 kwh. out of a plant total of 20,649,300 kwh. Total fuel cost for the gas engines was 1.68 mills per kwh. while fuel for the entire plant cost 2.83 mills.

In 1948, the gas units produced 11,842,300 kwh. of the plant total of 23,179,300 kwh. The Duafuel engines maintained their fuel cost of 1.68 mills but rising prices on oil used by the other diesels pushed the plant average up to 3.26 mills.

For much of 1949, there were three Duafuel engines in service and their production totaled 16,352,700 kwh. at a low fuel cost of 1.65 mills per kwh. Plant total was 24,476,100 kwh. and the increased production of the gas units brought the plant average down to 2.80 mills.

The year 1950 was the first in which all three Nordberg Duafuel engines were in operation throughout the year and they produced 25,811,200 kwh. of the plant's total of 28,364,005 kwh. This high gas unit generation at a cost of only 1.62 mills brought the plant average to a low 1.71 mills.

Two major factors contributed to the achievement of this notable economy: first, comparatively low fuel prices; second, a high degree of operating efficiency. Natural gas with a heating value of 1000 Btu. per cu. ft. costs 12.5 cents per mcf. during the eight summer months and 15 cents for the four winter months. A 28 gravity diesel oil at 8.5 cents a gallon is used for pilot fuel. But these moderate prices are just half the story. In the 1950 fiscal year the three gas-burning Duafuel engines produced a kilowatt-hour on a consumption of just 10.15 cu. ft. of gas and .0044 gal. of pilot fuel. In terms of Btu., gas contributed 10,150 and oil 626 for a total of 10,776 Btu. per kwh. Pilot oil was down to a lean 5.8 per cent. The plant staff feels that pilot consumption was actually lower than these records indicate, probably no more than five per cent.

The operating record of the 3600-hp. Nordberg engine, if considered alone, was even more impressive, with an average for the year of 9.82 cu. ft. of gas and 0.0040 gal. of pilot oil per kwh. Some months when load factor was favorable, gas consumption was as low as 9.4 cu. ft. per kwh.

In spite of the addition of the 2400-hp. engine in 1947 and the 3600-hp.

Lubricating oil is bypassed from the engine's pressure system through this purifier

unit in 1949, expansion of plant capacity has not kept pace with the rapidly growing load. Peak load was 4300 kw. in 1946, rose to 4750 kw. in 1947, then to 5200 kw. in 1948, a big jump to 6300 kw. in 1949, and up again to 6450 kw. in 1950. With all engines running, the plant can manage, with sufficient capacity for swings, a continuous output of 7000 kw., but firm capacity is only 5890 kw.

To adequately handle this increased load, Ponca City officials have ordered another Nordberg two-cycle Duafuel diesel engine. This engine has ten cylinders of 21 in. bore and 31 in. stroke and will develop 4275 hp. at 225 rpm. When installed, the new engine will give the Ponca City plant a total capacity of 16,275 hp. The plant staff made an exhaustive study of the various types of prime movers and other sources of power as a basis for their recommendations to the City Commissioners and say in their official report: "We found that steam turbines pulling city electric loads similar to Ponca City's used from 18 to 22 cu. ft. of gas per kwh., depending on the fluctuations of the load and the skill of the personnel. The power company, which operates a very efficient steam plant close to Ponca City on a base load furnishing power into a highline system, used 15 cu. ft. of gas per kwh."

Although there are only a few gas jet turbines operating in the United States, these were included in the investigation. They found that: "The two in Oklahoma, owned by the Oklahoma Gas and Electric Company, use from 25 to 34 cu. ft. of gas per kwh."

Thus, Ponca City's Duafuel diesels, with a consumption of 10.15 cu. ft. of gas per kwh. are decided by more efficient than even the base load steam plant. To make the fuel consumption figures truly analogous, we should include the pilot oil consumed by the gas engines. In terms of heating value, the pilot oil used per kwh. is less than the equivalent of 1 cu. ft. of gas. The cost of this oil would purchase just 2.9 cu. ft. of gas at the rate of 12.5 cents per mcf. Thus, by any standard of calculation, the gas engines operated more efficiently than the steam turbines.

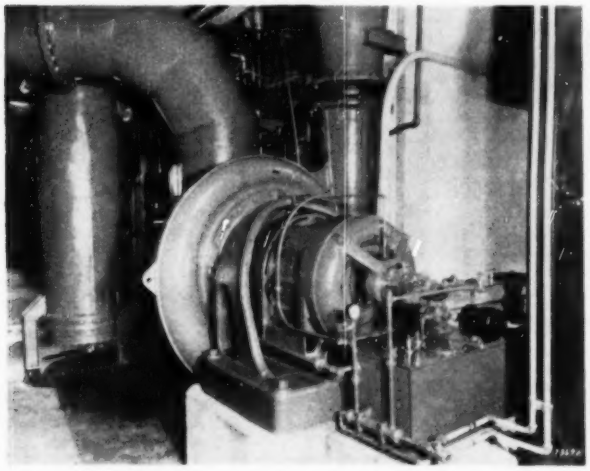
Surveying sources of purchased power, Ponca City found that electric cooperatives in the regions paid the power company 1.2 cents a kwh. at the substation. The City of Miami, Oklahoma purchased about 12,000,000 kwh. a year from Grand River Dam Authority for 5.73 mills a kwh. with another 2 mills for standby and depreciation costs at their own plant, making a total of 7.73 mills. By contrast, the total production cost at Ponca City for the fiscal year 1950 was 5.57 mills per kwh. This figure includes labor, fuel, lube oil, supplies, engine maintenance, renewals and repairs, water, light and heat, insurance and depreciation. Table I gives the detailed expenditures.

It is not surprising that the purchase of additional gas-burning engines was recommended. A $510,000 bond issue was approved by the public by an overwhelming 12 to 1 vote. The bonds

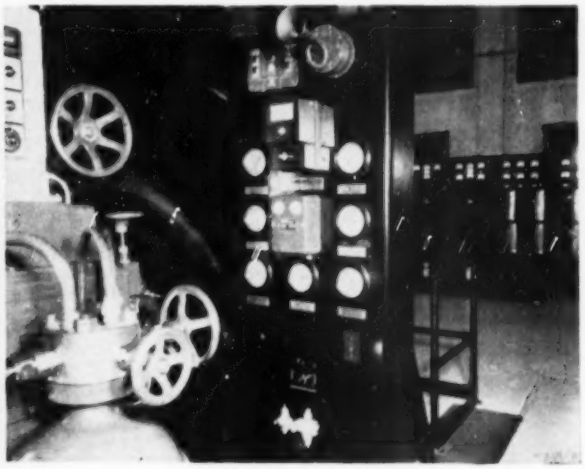
TABLE I
PRODUCTION EXPENSES
Fiscal Year Ending June 30, 1950

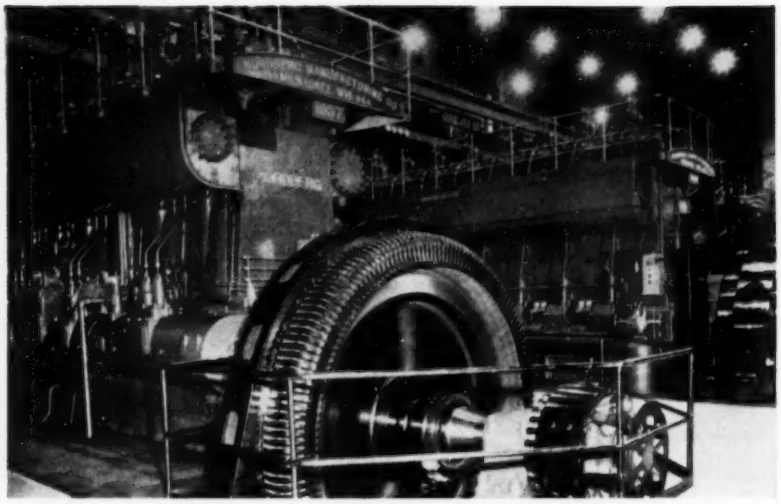
	Total $	Mills per KWH
Salaries	42,682.47	1.50
Renewals & Repairs	4,691.42	.17
Supplies	2,928.62	.10
Insurance	6,301.60	.22
Depreciation	34,620.77	1.22
Water, Light, Heat	4,375.20	.15
Fuel	48,249.21	1.71
Lube Oils	4,079.54	.14
Engine Maint.	10,110.52	.36
TOTAL	$158,039.35	5.57 mills

Motor driven turbo-blower supplies the engine's scavenging air.



Instrument board for alarms, gauges, gas controller, and pyrometer.





Installed originally as an air injection diesel in 1937 this 2250 hp. Nordberg was converted to Duafuel 10 years later.

are general obligation bonds and will be paid out of the substantial annual profits. In 1950, operating income totaled $822,104.96. Expenditures were $158,039.35 for power production, $89,282.30 for distribution and $22,936.82 for general expenses, a total disbursement of $270,258.47. This left a net profit of $551,846.49 for the year.

Ponca City's profitable gas engines basically are Nordberg's Duafuel diesel engines with a separate set of small fuel pumps to handle pilot oil, the regular fuel pumps serving as actuator pumps, and the compressors raising gas to high pressure for injection. The gas comes to the plant at 75 lbs., passes through a meter, three scrubbers and then an individual regulator for each engine which cuts pressure to 35 lbs. The engine compressors then compress the gas to 1150 lbs. for injection. The pilot fuel, stored in an 11,000-gal. tank outside the plant, is pumped through meters to 400 gal. overhead day tanks and then through duplex filters to the engines.

All the Nordberg engines can be converted to oil, if necessary. In that case they would burn the 10 gravity fuel oil which is used for all the oil-burning diesels in the plant.

Gas operation has resulted in improved lubricating oil economy. In 1950, the three Duafuel engines consumed a total of 7886 gal. of lube oil for a high average of 7400 rated hp. hrs. per gal. The 3600 hp. engine averaged 8312 hp. hr. per gal. of lube oil consumed. The plant uses a detergent oil in the cylinder lubricators and a straight mineral oil in the crankcases for bearing lubrication and piston cooling. Lube oil from the crankcase supply is cleaned continuously with fuller's earth filters. The lube oil is kept in good condition and the engines are always kept clean.

The gas-burning Duafuel engines, of course, are run in preference to the oil engines and the load demands a heavy operating schedule. The big 3600-hp. unit is the work-horse of the plant, running 8450 hours in 1950, more than 96.4 per cent of the time.

In maintenance, a progressive system is used in place of the annual overhaul. One or two pistons are pulled during the day, inspected, serviced and replaced so that the engine can be put on the line to help carry the evening load. Each piston is checked twice a year. Bearings and valves are serviced in the same manner —valves every 3000 hours, crankcases once a month. The progressive system is essential in a plant which cannot spare its major engines for the average overhaul period, but the staff feels it pays dividends since the engines are always in peak condition and preventive maintenance frequently averts major repairs.

With the addition of the new Duafuel engine the oil engines will be retired to standby service and virtually all power will be generated with gas fuel. Ponca City has achieved a notable record of efficiency and economy in the past years. All evidence points to even greater economy and greater profits in the years ahead.

Principle Equipment for 3,600 hp Nordberg

Engines	Three Duafuel Diesel engines. 3,600 , 2,400 , and 2,250 hp. Nordberg Mfg. Co.
	Three 1,250 hp. Diesel Engines Nordberg Mfg. Co.
Turbo-blower	16,500 cfm., 3550 rpm., 2.7 lb. pressure direct-connected to 300 hp. 2400 volt line start induction motor. Allis-Chalmers Mfg. Co.
Gas	Northern Oklahoma Gas Co.
Gasregulators	Fisher
Gas Meter	Metric Metal Works
Gas scrubbers	Blaw-Knox
Fuel Oil	Conoco. Continental Oil Co.
Lube Oil	Conoco. Continental Oil Co.
Fuel filters	W. W. Nugent & Co., Inc.
Fuel meter	Trident , Neptune Meter Co.
Lube purifier	Honan-Crane Corporation
Auxiliary lube pump	Sier-Bath Gear & Pump Co., Inc.
Lube cooler	Ross Heater & Mfg. Co., Inc.
Water softener	International Filter Co.
Cooling water pumps	Peerless Warren
Air filters	American Air Filter Co.
Silencer	Maxim Silencer Co.
Switchboard	General Electric Co.
Alarms	Viking Instruments, Inc.
Pyrometer	Alnor. Illinois Testing Laboratories, Inc.
Gauges	Lonergan
Control on intake gas Regulators	Killey & Mueller, Inc.

Analyzing Maintenance Records

by Karl W. Stinson
Professor, Ohio State University

One of the most valuable sources of operating information in the power production field is the "Report on Oil and Gas Engine Power Costs" produced annually by a sub-committee of the Oil and Gas Power Division of ASME. For full utilization of the data presented, detailed analysis is necessary. It is wondered how many operators, engineers, and others take time to do this.

Just as an example of what can be done, a careful check was made and the results on one specific class of information; the number of various component parts used yearly. In addition to totaling specific entries mentioning the parts used, whenever an overhaul was indicated, the parts that are normally replaced were added to the total. This was done for three successive years.

Comparison was made on a parts per engine basis, for greater accuracy relation could be made to the total number of such components in the engines. This might lower the percentages, but it is felt would not greatly alter the overall relationship.

Now we have an imposing list of the major engine components and the average frequency of their replacement in a representative type of engine in a specific service. The problem is now one of interpretation.

First, we can determine a trend (referring to the percentage columns) as to whether the mortality rate of a particular component is increasing, decreasing, or remaining constant. Many components show such a low incidence of failure that a three year period is not sufficient for a valid analysis. In any case, it is apparent that they give little trouble and it can be assumed that their design and condition of operation is adequate.

This permits concentration on the more troublesome items. Connecting rod and main bearings, pistons, and piston rings are the worst offenders, followed by cylinder heads and liners, injection nozzles and exhaust valves. It should be noted that all of these components are the ones subjected to the greatest stress and/or temperature. They can be expected to have the shortest useful life.

DIESEL REPAIR PARTS (FROM OGP POWER COST REPORTS)

	1947			1948			1949		
	Number	%	Indicated Life, Yrs. *	Number	%	Indicated Life, Yrs.	Number	%	Indicated Life, Yrs.
Engines Reported	396.			469.			447.		
Bearings,									
Connecting Rod	80.	20.2	4.9	87.	18.4	5.2	92.	20.6	4.8
Main	58.	13.4	7.4	56.	12.8	8.0	77.	17.2	5.8
Piston Pin	12.	3.0		12.	2.7		12.	2.7	
Chain, Timing	1.	0.3		0.	0.0		2.	0.4	
Connecting Rod									
Bolts	6.	1.5		4.	0.9		3.	0.7	
Crankshaft Section	2.	0.5		4.	0.9		0.	0.0	
Cylinders & Liners	1.	0.3		2.	0.5		5.	1.1	
Cylinder Heads	45.	11.3	8.9	42.	9.4	10.6	38.	8.5	11.8
Fuel Lines	14.	3.5		19.	4.2	24.	27.	6.0	17.
Pump Push Rods	2.	0.5		9.	2.0		5.	1.1	
Gears, Timing	0.	0.0		0.	0.0		5.	1.1	
Governor Parts	5.	1.3		1.	0.2		0.	0.0	
Nozzles, Injection	5.	1.3		6.	1.3		8.	1.8	
Packing	26.	6.3	16.	26.	5.8	17.	18.	4.0	25.
Pins, Piston	3.	0.8		3.	0.7		4.	0.9	
Pistons	17.	4.3	24.	18.	4.0	28.	5.	1.1	
Pumps, Oil	41.	10.4	10.	47.	10.5	10.	40.	9.0	11.
Fuel	4.	1.0		4.	0.9		3.	0.7	
Rings, Air Valve	10.	2.5		15.	3.3		6.	1.3	
Compressor	0.	0.0		1.	0.2		4.	0.9	
Piston	0.	0.0		4.	0.9		0.	0.0	
Shafts, Cam	194.	49.0	2.	168.	37.4	2.7	189.	42.3	2.4
Crank	3.	0.8		2.	0.4		2.	0.4	
Springs	0.	0.0		4.	0.9		0.	0.0	
Valves, Air	1.	0.3		1.	0.2		4.	0.9	
Exhaust	4.	1.0		1.	0.2		3.	0.7	
Intake	16.	4.0	28	22.	4.9	20.	33.	7.4	13.
Valve Seats	9.	2.3		21.	4.7	21.	21.	4.7	21.
Miscellaneous	4.	1.0		1.	0.2		0.	0.0	
Engines Requiring	55.	13.9		49.	10.9		64.	14.3	
No Parts	200.	50.5		181.	33.7		149	33.4	

* Indicated Life- given only when 25 years or less.

Percentage-wise, the frequency of these failures remains substantially constant in view of the short period of three years under scrutiny. However, there is a slight up-trend from 1948 to 1949. This might be inferred to indicate that greater horsepower was being taken out of these engines in view of growing demands and then again, subsequent figures might refute the trend.

In any case, these figures can be used as a yardstick against which to measure individual engine or plant performance. If the number of the various parts used each year over a reasonable period (this can be taken from the records) does not conform to the pattern within practical limits, attention should be given to these items. All factors such as the particular engine design, operating conditions, etc., should be given weight in this evaluation.

Another use of this data is for the establishment of "usage factors". With this data it is possible to determine with reasonable accuracy the numbers of each type of component that should be on hand for scheduled and unscheduled repairs. Where the actual number of parts used is not known, as might be in the case in a new plant or one with incomplete records, the usage factors serve as a basis for ordering replacement parts. This is becoming increasingly important as the necessary lead time for delivery is stretching out further and further.

Finally, these figures show the areas where there is the greatest room for improvement both from the design and the operational point of view.

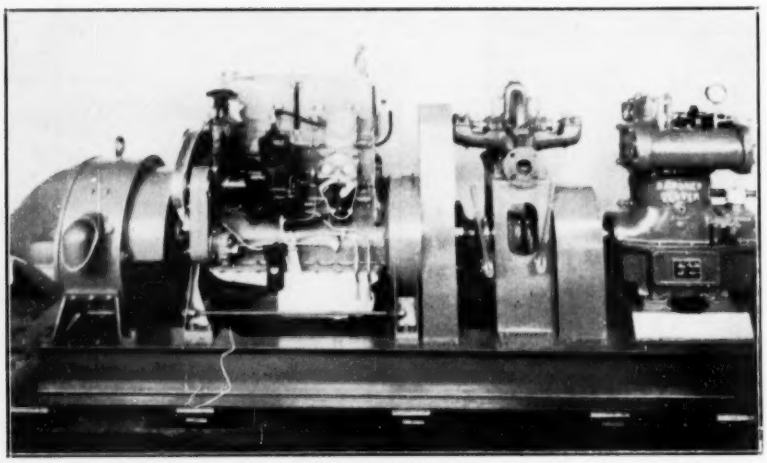
Granting that all of the troublesome parts are required to live in difficult environments, how do we know that 42.9 per cent for pistons (average for the three years) is the best that can be achieved? Perhaps, im-

(Concluded on Page 89)

Isolating Machinery Vibration

by Kelcy Kern

Rubber and cork are the vibration dampening media chosen for discussion by the author. However, the principles apply to the use of spring type isolators and others.



Cummins powered combination unit of the type common for marine auxiliary application. Generator, pump and compressor, selectively driven by the engine, are all mounted on a common sub-base vibration isolated from supporting structure.

MUCH will depend upon machinery and its steady and efficient operation and use in meeting the power requirements of national defense. Along with man-power problems, the rate of production per man hour, industry today must likewise confront that of getting the utmost out of power plant "machine hours". One means of doing this, at least partially, is by remedying as much as a ten per cent loss of potential energy and machine performance due to machinery vibration.

The machinery industry and the power and industrial machinery user have tended to greatly under-estimate efficiency, production loss and increased operating costs due to such vibration. Only in recent years has the true picture of such loss and the fact that correctives are possible, been realized among machinery builders and users.

Reliable estimates based upon careful tests and studies reveal a somewhat surprising tally of "costs" due to vibration, inherent to some extent in nearly every type of machinery used in power production and transmission today. Such correctives now:
(1) *Save on structure's maintenance cost. With proper isolation of machinery, the building foundation need be less thick and much less costly to lay. Also true of the upper floors.*
(2) *Bring greater all around operating efficiency.*
(3) *Add to the employe's safety margin and tend to improve workers' health.*
(4) *Reduce loss in production.*
(5) *Greatly increase output per unit.*
(6) *Reduce maintenance costs by having fewer replacements of wearable machinery parts.*

The fact is that any piece of power machinery may show a reduction of potential output of from ten to twelve per cent, and even more, unless proper correctives are applied to offset these tendencies; and this vibration which is, in effect, useful and usable energy finds its terminus in the foundation of the building on the ground below. The effect of this waste, it will be easily recognized, is to put a tremendous extra and useless "load" on the nation's machinery "plant" at a time when every effort is being strained to produce more, to produce it faster and better.

Year by year remarkable progress is revealed in eliminating machine vibration and the topic is of direct and special interest just at this time. Tests and studies have proved that the proper and scientific isolation of machinery to prevent the transmission of vibration has become one of the really important phases of modern engineering.

In an interview with this writer, Mr. B. A. Doane of the Vibration Elimination Company, pioneers in this field, said:

"Because concrete, steel, and other building materials are all conductors of vibration, all mechanical equipment should be isolated. Properly planned isolation acts not only as a shield to prevent vibration transmission to the foundation, floor, the building structure and surrounding equipment, but it also materially reduces dynamic bearing loads.

"When any machine is rigidly mounted upon a solid support or foundation, vibration loads are added to the normal operating loads. These combined loads are frequently of such magnitude as to definitely increase the wear of moving parts. The cushioning effect of isolation permits all parts to operate freely, with a resulting reduction in wear.

"Effective isolation is not the mere interposition of a resilient material or system. Incorrectly applied isolation may even aggravate the vibratory condition. To be of any value the isolation material or system must be resilient under the condition of installation; that is, under the impact of operation, it must have a certain predetermined action.

"Briefly, if the isolation system is under-loaded it cannot be resilient. Its reaction will be the same as that of a solid mass, and it will transmit vi-

bration. At the other extreme, if the isolation system is overloaded, fatigue results, with a complete breakdown of the resiliency factors. It is clear to the trained engineer, therefore, that the isolation material must be properly loaded for maximum isolation efficiency. Isolation cannot be purchased by measuring the base or foundation and ordering so many square feet. In practically every instance the isolation material will be definitely underloaded and virtually useless."

Of course, it is a well known fact in the machinery field that a blanket recommendation for isolating any and all types of machinery is impracticable. Yet, as has been pointed out, each job doesn't necessarily have to be a "tailored" one, thanks to improvements in modern methods of isolation. The present wide selection of unit isolators brings to the machinery manufacturer or user a choice of vibration eliminators all designed to remedy that most common factor — "under-loading". Not only do these modern isolation units make it possible to "control" the load, but their installation is an extremely simple matter under proper supervision, based upon experience.

To a great extent rubber has become the basic factor in designing and building the new range of vibration isolators which today can be adapted to meet any need. It should be remembered, however, that rubber does not have elasticity by volume. For this reason, rubber under compression evidences resiliency only by bulge around the edges, and is limited in use as a vibration eliminator.

However, the vibration isolation engineer today utilizes the full advantage of the natural elasticity of rubber by employing moulded rubber or rubber bonded to metal both having cross sections that permit them to act freely in shear. This same principle of rubber-in-shear has been used to develop a variety of unit isolators having provisions that permit bolting to a machine and also the supporting structure.

Problems of resiliently supporting small loads ranging from a few ounces to several pounds present difficulties not found in handling heavier loads.

Tips On Vibration Elimination

Don't—

put a solid sheet of cork, rubber or other material under a complete base.

neglect the overhang of the drive or the machine will rock.

use a material that will soften in hot weather or harden in cold.

use a material that is brittle, too hard or too soft.

use a "lifeless" isolator. It is sure to pack and settle in time.

Do—

allow for uneven distribution of weight. It is vitally important.

mount the driver and driven equipment on a common frame before isolating.

use good isolators, well engineered and where possible get competent engineering advice.

In overcoming these difficulties, no isolation material has proven more effective than rubber. Because of this effectiveness, isolation engineers have developed a wide variety of designs using rubber-in-shear for resiliency and rubber in compression for stability, thus enabling the application design engineer to consider the particular problems of installation when selecting the units for the job.

The application or adaptation of these standard units and the conception of new designs for special jobs is a large part of vibration isolation engineering today, and eliminates the possibility of overlooking local conditions peculiar to a specific job, which exist when an attempt is made to select the mountings from a catalog.

"Go wash up and change overalls. You're supposed to be cleaner than the injection pump!"

Cork, too, has its place in modern vibration elimination. Natural cork plates call for the same accurate loading for maximum efficiency as do other systems of isolation. The table of loading that has been calculated for these other systems may be used just as successfully for natural cork plates. Results are greater efficiency and lower cost. Cork plates are made from a pattern of strips of pure natural cork with a steel confining frame. Natural cork plates may be installed under continuous contact with oil without losing their efficiency.

The use of vibration eliminator rails for certain types of machinery has greatly increased. These rails are supplied both in rubber-in-shear and in cork.

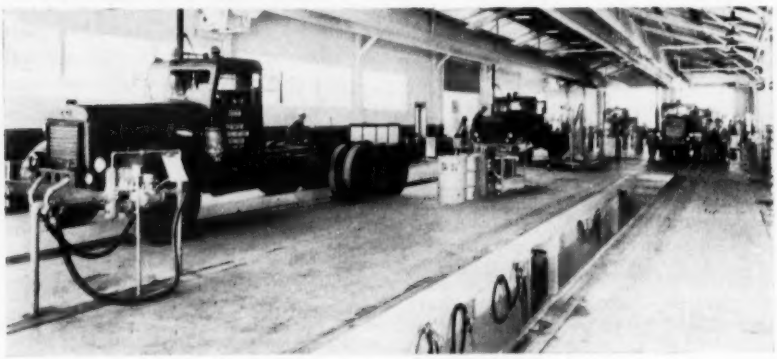
Both designs are convenient and effective, since they are supplied in lengths to meet conditions, and the built-in isolation units are located according to the distribution of the weight of the machine. These isolation units are metal housed and locked in place. The housing provides a level bearing surface on the cork or rubber. Rails are drilled and tapped for machine foundation bolts with ample threading surface. Where driver and driven equipment are not on a common base or where the machine base itself needs continuous support the rails provide this necessary base and support.

These rails also help to distribute the weight over the floor area since the bottom member extends the entire length of the rail. Installation is relatively simple as extending lugs at the ends of the rails are drilled for lagging to the floor. The cork rails are used where contact with oil is possible. The rubber rails are recommended where the supporting structure is not rigid.

Today, vibration of industrial machinery is a known factor, and its results are a known fact. Modern engineering has given increased attention to this important production-management question, and the results of the modern engineer's work has been realized in the design and manufacture of greatly improved and more flexibly applied vibration isolators.

PIE Maintenance and Operational Practices

A description of the operations of Pacific Intermountain Express Co. is presented in the following article. PIE was the winner in the For-Hire Carrier Class with more than 400 vehicles of the 1950 Truck Shop Excellence Award sponsored by "Transport Topics." While PIE is considerably larger than most trucking outfits, it is felt that their method of achieving remarkable economies even though plagued with a mass of conflicting state laws, their maintenance program and shop practices will be of interest to the trucking industry as a whole.



Well equipped and lighted lanes permit under chassis inspection and lubrication in PIE'S general shops in Denver.

At the present time the Pacific Intermountain Express Company owns and operates 241 over-the-road tractors, 535 over-the-road semi-trailers, 28 of which are equipped with refrigeration, 126 city delivery trucks and tractors, and 165 city delivery semi-trailers. Sixty per cent of the fleet is less than two years old, while only 5 per cent, mostly city delivery trucks, was more than nine years old.

Over-the-road tractors are Peterbilt with Cummins engines, GMC 953 and GMC cab-over-engine 743 tractors.

City delivery trucks and tractors include 86 Fords, 63 Dodges, 7 GMC's, 20 Macks, 6 Ward La Frances, and 30 Internationals. The trailer fleet consisted of 560 Brown aluminum trailers, 2 Cleghorn, 30 Fruehaufs, 1 Keystone, 1 Kingham, 2 Reliance, 7 Superior and 97 Trailmobile. The over-the-road tractors are of the 6 by 4 type and the trailers are tandem-axle semi-trailers.

Regular common carrier interstate freight services are offered by PIE in California, Nevada, Utah, Idaho, Wyoming, Colorado, Kansas, Missouri and Illinois. Through service is offered between Chicago and St. Louis on the east and Los Angeles and San Francisco on the west. In addition coast to coast service is available through cooperation with Mid-States Express Lines.

Commodities handled by the company include dry freight, frozen foods and fresh fruits and vegetables. The refrigeration equipment on the semi-trailers uses dry ice with a fan control system developed by PIE. A separate engine generator set is mounted on the trailers to furnish an independent source of electricity for the thermostat-controlled fans, which circulate the body air over the outside of the dry ice locker.

In 1950, the company's over-the-road tractors operated 32,175,735 miles for an annual average per tractor of 220,000 miles. City delivery power units averaged 8,433 miles during the same year.

The remarkable annual mileage of road tractors results from the round-the-clock operating schedule of the line. Loaded tractor semi-trailer combinations are started every two hours or less from each end of the Los Angeles — San Francisco, Chicago — St. Louis route. At spaced intervals during the day scheduled runs are started from other eastern and western terminals. Necessary extra runs are spaced between the regular schedules, as required to meet local demands.

All through runs pass through Denver, with the larger western tractors turning around there after inspection and service. The eastern tractors likewise turn around in Denver after inspection and servicing. Loaded semi-trailers run to the ends of the line.

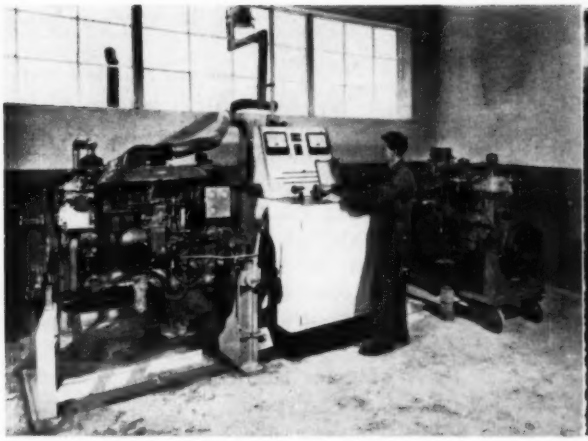
Three types of power units are used in over-the-road service. The largest and longest wheelbase tractors (including the PIE designed "dromedary") are used between Denver and the West Coast to take the most advantage of California size and weight regulations. The tractors used between Denver and Kansas City have a shorter wheelbase to comply with size regulations in Kansas. Power units used east of Kansas City were formerly operated under lease from private owners, but recently company policy has been to incorporate these privately owned vehicles into the company, and at the present time there are no vehicles under lease. GMC 740's are now utilized between Kansas City and Chicago and between St. Louis and Kansas City.

Location of Shops

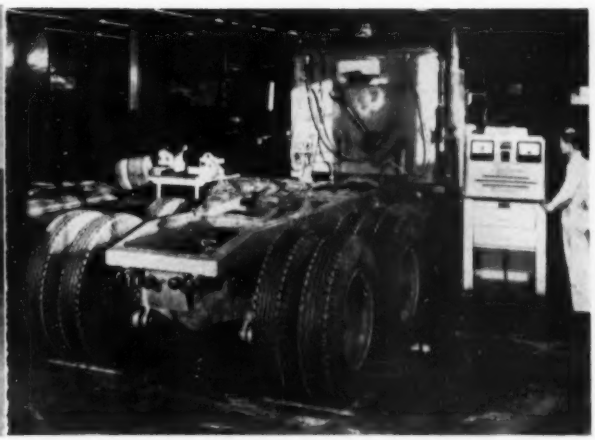
The PIE main shops are located in Denver, in a new building constructed for the purpose. Secondary shops are located in Oakland, Calif.; Los Angeles, Salt Lake City, Kansas City, Denver and Chicago. City delivery trucks are serviced and repaired at the company's secondary shops.

All company road tractors terminate runs in Denver, the prime reason for the location of the new plant there.

A feature of the line operation is that the power unit goes on, even though the drivers change at division points at less than ten-hour driving intervals. The drivers shuttle back and forth between their division points and



Rebuilt engines are run-in under part load followed by full load and speed run on dynamometer.



Chassis dynamometer is used for routine tests of engine power output and overall performance.

thus do not have the same tractor for two successive runs.

Standard Adjustments

All preventive maintenance adjustments are made to a specified standard to make the manipulation of tractors as near identical as possible. The two transmission shifting levers are bent to standard shapes and positions that were selected by a committee of drivers as being the most convenient to operate. Clutch, brake and throttle pedals are kept in identical positions and pedal pressures for the respective pedals are the same on all tractors. Safety kits and other operation accessories are stored on each tractor in specified containers, several with seals, so that a driver can quickly check his accessory equipment before starting a run. In addition, the shop checks the accessory equipment at the time of preventive maintenance inspections to see that the accessories are in good order and in place.

An equipment record and maintenance log book is carried on every tractor. Included in this log book are copies of daily "Driver's Trip Report". The report is made out in duplicate and contains space for the comments of four drivers—sufficient to carry a tractor between minor inspection intervals.

At each inspection station, items reported by the recent drivers are checked and adjusted if possible. The inspector makes a report of his findings and corrections on the back of the report and forwards one copy of the completed report to the fleet maintenance office. The other copy remains in the log book, with a new set of report forms being placed on top of the previous reports.

A chart showing the schedule of regular preventive maintenance inspections is included in the log book. As inspections are completed, the shop doing the work marks the date and its code name in the appropriate place, so that any shop can, upon reference to the log book, quickly determine the work it is to do on the tractor, as well as any reports of poor operation since the previous inspection.

Somewhat similar log books, except with different inspection guides and schedules, are kept with each trailer.

The Driver's Trip Report also has spaces for recording the amounts of fuel and lubricating oil taken by the tractors at stations. Space also is provided for recording interior body temperatures of refrigerated trailers at the start, halfway and end of each driver's run. Tire changes, including tire serial numbers, are recorded on the report.

With such long routes and operation schedules as PIE uses, road failures are definitely among things to be avoided. In event of a road failure, the driver must make a detailed "Equipment Failure Report", on which he reports his analysis of the cause of the failure, repairs made en route, starting time and place, and time resumed run. The report first goes to the district maintenance supervisor, who adds his comments and findings on the cause of the failure, and then to the fleet maintenance superintendent, who fixes responsibility for the failure. A continuing study is made of these reports to determine whether a specific part of the equipment is subject to premature failure, or whether the maintenance program needs to be revised to provide closer inspection. Any road failures also are recorded on the history record of the individual vehicle.

One company report that is of interest to both the operating maintenance departments is the monthly tractor utilization summary. According to the definition, "Line-haul tractor utilization is the ratio of actual miles of use to maximum possible miles. The maximum possible miles is computed by using the actual running time between two terminals plus one hour allowable division point delay, plus hostling and fueling along with an estimated service and maintenance allowance including road breakdowns or unusual repairs. (Service and maintenance allowance time is computed as 10 per cent of total possible monthly hours). Actual mileage is recorded from driver's log for each tractor, indicating the number of trips made between terminals and their respective mileages".

During 1950 the system utilization of tractors was 98 per cent, allowing 10 per cent for maintenance and terminal dispatch time.

Fundamentally, the Denver shop checks the line haul equipment with the idea that the vehicle will make a round trip without requiring more than the minor servicing operations which are specified in the series of preventive maintenance guides, and

Engine overhaul area and machine shop in PIE's Denver shops.

which are done at the secondary shops.

The Denver shop is divided into three parallel sections, each with approximately equal floor area. The center section includes the general maintenance office, boiler room, employes locker and toilet rooms, and replacement unit and parts storeroom.

One of the outer sections of the building is set up for preventive maintenance work on both tractors and trailers. Preventive maintenance work is done on a progressive production line basis for both power units and trailers. Two lines are arranged for tractors and two lines for trailers.

At the entrance to the trailer line there is a mechanical body washing machine. At periodic intervals the running gear of the trailers is steam cleaned before the body is run through the wash machine.

Small, specially built tractors are used to tow the trailers through the wash machine, as well as handle the trailers through the trailer inspection and lubrication lines. All trailers en route through Denver are washed and go through the service lines. Trailers are washed either loaded or empty.

Next is an area where trailer refrigeration equipment is serviced and inspected. Mechanical, electrical and tire inspection and preventive adjustments also are made in this area.

The trailer then is moved to a lubrication section where power grease guns enable a rapid and accurate lubrication of the running and landing gear. If ready for service, the trailer is moved to the outgoing parking lot or to the dock if it is to be loaded or unloaded in Denver. On through runs, the schedule allows four hours from the time a combination enters the yard until it is started on the road again. Tractors are allowed this same four-hour period for preventive maintenance work.

Tractors enter one of two inspection lines, depending upon whether they are scheduled for a check on the chassis dynamometer. Tractors are given a dynamometer check approximately once a month or oftener if any complaints about engine performance are recorded.

Upon entering the building, tractor cabs are washed outside, cleaned inside and the running gear is steam cleaned. After a drying period, the tractor moves to the next work area. In one lane in this area is located the chassis dynamometer, while in the opposite lane is a place for routine mechanical, electrical and tire preventive maintenance work.

Chassis Dynamometer

The chassis dynamometer is equipped with extra, free-running drums in back of the dynamometer power rolls, to permit the rear wheels of the 6 by 4 tractor to run while the forward wheels operate the dynamometer.

Any tractor going over the dynamometer is given a complete preventive maintenance inspection according to an inspection guide, and a report is made of conditions found, adjustments made, and whether tractor is ready for service or needs repair or overhaul work. Small accessory units may be replaced in the inspection area, but for large unit replacements, the tractor is moved to the repair and overhaul section of the shop.

Front wheels are balanced in this area with a portable type of electronic wheel-balancer, which does the balancing job with the wheels in place on the tractor.

Wheel bearings are repacked every 67,000 miles. Wheel bearing adjustments are checked at inspection periods by putting a pry bar under the outside tire of a jacked up wheel and lifting the tire and wheel assembly. With experience, the amount of play can be accurately judged by the amount of bump observable when tire and wheel are suddenly released.

Tractor Lubrication

If ready for service, the tractor is then moved to one of two long pits for lubrication, oil changes and under chassis inspection.

The scheduled operations of PIE regularly brings all road tractors into Denver, where each unit undergoes one of the series of six preventive maintenance check guides. The specific inspection guide used depends upon the mileage since the previous inspection. A number of the minor inspection checks are performed at the secondary shops, but the major inspections are all performed at Denver.

A. L. Springer, Fleet Maintenance Superintendent at Denver, believes this tight preventive maintenance schedule has real advantages since it results in the use of the best inspection equipment and facilities. He also said it keeps the mechanics on their toes in inspecting or adjusting a vehicle or determining whether repair or overhaul work is necessary. If overhaul is scheduled, a replacement tractor is supplied for the run.

All PIE tractors have vertical exhaust stacks. To catch and remove exhaust fumes from the shop two long inverted U-shaped ducts are suspended from the ceiling members directly over the inspection lanes. The open bottom ducts are equipped with two power-driven exhaust fans, allowing all exhaust gases to be carried immediately out of the building, even though a tractor may be running at full load and speed on the chassis dynamometer.

Overhaul Shops

The third section of the building at the opposite end from the maintenance

lanes contains the tractor overhaul, trailer overhaul and unit rebuilding shops and paint spray room. This section has doors at each end and on one side, so that vehicles may be brought directly into repair or overhaul stalls from the outside yard.

With the exception of crankshaft regrinding, spring repairs and tire repairs and recapping, the Denver shop does all repair and overhaul work on line haul vehicles and Denver city trucks.

Because of the high mileage of the road tractors, all were rebuilt at least once during 1950 and a large proportion went through the shop twice during the year. A total of 240 diesel engines were overhauled during the year. All line haul vehicles were repainted during the year.

The overhaul work on both tractors and trailers follows progressive steps. A tractor for overhaul first is brought into the cleaning bay. After cleaning, it is moved to an area, which has a clean floor, free of grease and cleaning solution.

Units are removed from the chassis frame in major assemblies, such as radiator and supports, engine and transmission, front axle with springs, rear axle bogie assembly with spring, fifth wheel, and so on. The stripped frame and cab are then carefully inspected and repairs made as necessary.

After this preliminary work, rebuilt units are drawn from the storeroom and assembled on the chassis. Before the tractor is returned to service it is given a final test run on the chassis dynamometer. These regular overhaul jobs are turned out in less than 48 hours, including a repainted cab.

A unique feature of the overhaul bay is the use of heavy-duty floor cranes, and a mobile crane for removing and installing chassis units. The floor cranes are mounted on large roller wheels, which enable easy movement of the crane for positioning units on the chassis frame. For vertical movement of the crane arm, there is a hydraulic cylinder operated by a manual pump.

Next to the overhaul bay is a pit equipped with frame straightening machinery and gauging equipment for wheel and frame alignment.

Parts storeroom, where reconditioned replacement units ready for immediate installation are kept.

For trailer repair and overhaul, two stalls are provided at one end of the overhaul shop. A unit replacement of running gear parts is followed on trailers, with other repairs being made on an inspection basis.

After used units have been removed from a vehicle, they are returned to the cleaning section. Here the units are dismantled by the cleaner staff. All dismantled mechanical parts are thoroughly cleaned in a hot alkali solution. Two tanks are provided for this use, one equipped with a swinging job crane for handling heavy pieces. Benches, holding fixtures, and adequate wrenches are provided in this area for any dismantling operation.

All Parts Checked

The cleaned and dissembled parts are checked for scrap, salvage, remachining or re-use. Certain stressed parts are checked further for metal defects or cracks on a Magnaglo testing machine. Usable parts are sent to the stockroom for re-issue, and repairable parts are sent to appropriate departments or outside shops for repair, after which they are returned to the stockroom for re-issue.

Identification tags are placed on all units removed for repair or overhaul. A white tag is placed on the unit by the mechanic removing the assembly. On this is written the part name, company serial number if it is a unit which carries a serial number, tractor from which removed, shop name, and reason for removal.

After the unit has been cleaned and repaired it is given a green tag which shows its identification and type of vehicle on which it is used. Repaired parts and units with green tags are carried in the stockroom for normal disbursement. Parts or units which are rejected by the inspector and are to be junked are marked with a red tag. Units are shipped to the Denver shop for overhaul from all stations on the system.

Standard parts list have been prepared for all assemblies rebuilt in the Denver shops. Thus when an order is placed on the stockroom for parts to assemble any unit, the order is made up according to the standard list. For certain large assemblies, such as engines, special parts carts are provided which have fixtures and compartments for holding different parts or sub-assemblies. Both new, used and rebuilt parts are issued by the stockroom.

Also shown on the standard parts list, are fit tolerances allowed for essential close fits. These tolerances are a guide to the assembler in fitting two used parts or in fitting new and used parts. In cases where the fits do not meet the established tolerances, other parts may be drawn from the stockroom.

The engine builder is essentially an assembler, whose job is to assemble the parts and sub-assemblies and see that the fits meet the prescribed tolerances. Sub-assemblies, such as fuel pumps, injectors, cylinder heads and piston and connecting rod units, are overhauled in small specialist shops.

As an example, cylinder heads are reconditioned in a small shop which has a turntable fixture for holding the head in convenient positions for reconditioning and assembling the head with valves and springs. This shop has a valve refacer, a valve seat grinder, valve spring tester and several gauges. A small dry ice box is used for shrink-

ing valve seat inserts previous to installation.

Piston Assemblies

Connecting rod and piston assemblies are handled in another small department. Here the wrist pin bushings are bored on a machine with a fixture which holds the distance between the centers of the big end bearing and the wrist pin bushing to prescribed limits. Piston pins are fitted to both piston and rod and the assembly is completed. Then the assemblies are carefully weighed and sets of six equally balanced piston and rod assemblies are placed together in a carrier for return to the storeroom.

Fuel pumps and injectors are overhauled in a room which can be shut off from the rest of the shop. This room has a separate solvent tank for cleaning pump and injector parts. After assembly the fuel pumps are checked on a test stand for calibration, and the injectors are checked for their operation.

After an engine has been completely assembled, it is taken to the engine dynamometer room where it is run-in for a period under partial load, ending with a full load test to determine whether the engine will produce the specified horsepower output. Engines are handled on special cradles with wheels for easy moving.

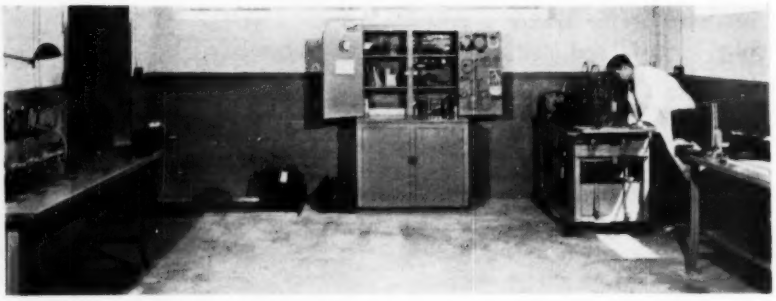
The electrical shop has equipment and fixtures for overhauling and testing generators, regulators and starters. Final testing of generators and regulators is done on a heavy-duty motor driven test stand, and generators and regulators are handled as matched sets.

Equipment for other types of repairs is located in this same section of the building. There is a separate welding shop for repair and salvage work. This shop adjoins the tractor repair stalls, so that frame repairs can be made conveniently. Parts for salvage by welding are brought to this shop and then sent to other repair stations for finishing.

In the machine shop area are lathes, drill presses, a brake drum grinder and other necessary machines and tools for repair finishing operations.

Tires Branded

New tires are given a PIE serial number which is branded on each side of the tire. Recapped and repaired tires are not used on front wheels.



Enclosed shop, spotlessly clean, for the complete servicing of fuel pumps, and injection equipment.

All tires are mounted and dismounted by the Denver shop for line-haul vehicles. Equipment includes a tire spreader for casing inspection and a power device for pushing off tight fitting side rings and tire casings. In the tire shop is a homemade fixture consisting of a wheel hub with bearings mounted on a wall bracket. Wheels are placed on this fixture and revolved against a dial indicator to check run out of wheel and rim. Any damage to wheel or rim also is found at this inspection. After tires are fully inflated, which is done in an open-work pipe cage, the diameter of the tire is measured with a height gauge fastened to the wall. The diameter of each tire is marked on the inflated tire for mating purposes. Mating diameters of tires are also checked with a caliper on the vehicles at 4000 mile inspections.

Complete tire records are kept of each casing, and a record is made of the reason for tires being removed from service.

Detailed record cards on each road tractor are kept by the fleet superintendent's office in Denver. There records are on 8 by 5 cards in a visible card file. One card contains specification data, license registration data, and modification record. A second card follows up on scheduled maintenance inspections, and wheel bearing repacking. On the back of the card are spaces for recording the history of replacements of major components such as rear-ends, transmissions, etc.

The third card is a daily record of fuel and engine oil consumption by operating districts. From this card, fuel and oil economies are computed, and the monthly averages are tabulated on another card with space for seven years' entries. Card records also are kept on major component units to follow their performance from one vehicle to another.

A continuing study of these records reveals the operating efficiency of tractors and components. Also the study provides statistical information for use in determining the effectiveness of the preventive maintenance program, and need for any changes.

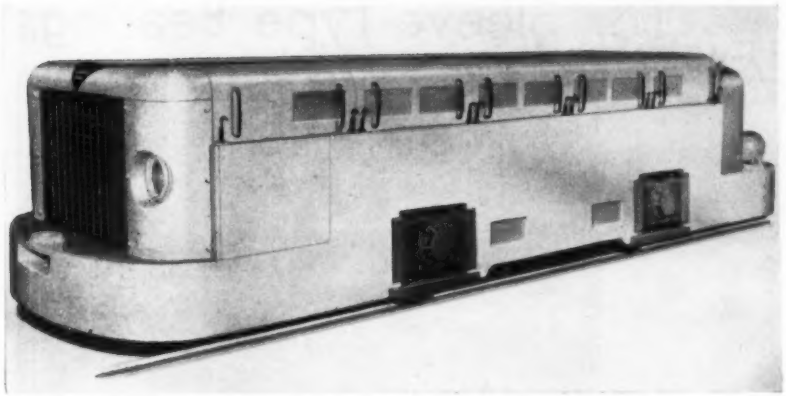
Detailed cost figures are recorded for all operations and are recapitulated monthly.

During 1950, the fleet average for mileage between mechanical road failures was 60,608 miles, while the average mileage between tire changes was 53,210 miles. Diesel fuel economy for line-haul equipment was 5.9 miles per gal. Average mileages for new tires was 58,512 miles and 34,323 miles were obtained per recap with many tires being recapped more than once.

The average number of shop employes is 377, including all the secondary shops. Shop employes include 21 supervisors and foremen, 285 mechanics, 6 painters, 25 lubrication men, 15 tire men, 19 washers, 21 stockroom employes and 8 clerical workers. Man hours per month for maintenance and repair of rolling stock amounted to an average of 141 man hours per power unit.

Tachographs operation recorders are used on all line-haul tractors. Maximum allowed road speed is 50 miles per hour. Road tractors are equipped with engine tachometers and drivers operate transmissions to keep engine speeds within prescribed high and low engine speed limits.

Diesel Mine Locomotive



Diesel locomotive for operation in mine shafts. Unit is powered by a Hercules 6 cylinder diesel engine and has a height of only 45½ in.

DIESEL locomotives have made their appearance in mining operations. The first diesel locomotive to be approved by the U. S. Bureau of Mines was introduced to the mining industry at the Coal Show in Cleveland recently.

Developed by the National Mine Service Company, the new unit is a 10-ton locomotive which stands only 45½ in. high. Other specifications of the new locomotive are length 17 ft. 3 in., width 5 ft. 6 in., wheelbase 75 in., and track gages of 42 in. to 48 in. Diesel application to mining, makes possible a haulage system that eliminates sub stations, feeder lines, conversion equipment, trolley wire, poles, line material, rail bonding, etc.

Although operating costs are low, the outstanding features of the new unit are its safety characteristics. In order to safely operate underground, and earn approval of the Bureau of Mines, a diesel locomotive must meet many requirements. Primarily, it must operate without emitting into the air hazardous quantities of carbon monoxide, and it must be flame proof, so as not to ignite any explosive mixtures of gas or coal dust that are frequently found in mines.

The removal of gases and impuritites from engine exhaust is accomplished by a specially designed exhaust conditioner which washes and cools the exhaust. Operation of the engine with an excess of air assures essentially complete fuel combustion and, therefore, a very low percentage of carbon monoxide in the exhaust. Flame arresters on the air intake and exhaust manifolds, as well as on the outby side of the exhaust conditioner make the engine flameproof. In operation no part of the exterior of the engine becomes warmer than 400° F, and final exhaust temperature is below the 160° F minimum set by the Bureau of Mines.

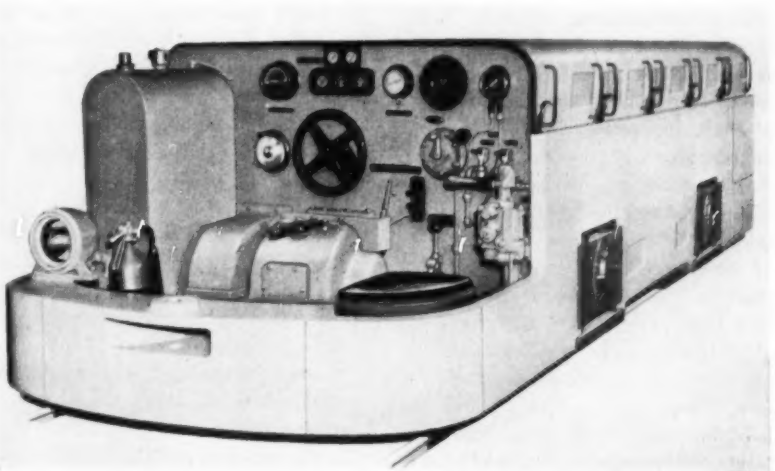
The engine of the new locomotive is a Hercules 6-cyl. diesel with an approved explosion tested starter and generator of Bemeco design and manufacture.

Engine power is delivered to the rails through a Twin Disc torque converter and Baldwin multiple Rex chain operating in a sealed case oil bath. Reversal of the locomotive is by means of a Cotta Transmission reversing gear box. Compressed air for the air brake system, is furnished by the 2-cyl. Westinghouse air brake compressor belt driven from the engine, and lubricated and cooled through the diesel engine system. A large capacity water tank and pump are also provided for the automatic addition of fresh water make-up to the cooling system.

This locomotive may be operated in single or double units and with one set of controls, thus doubling the power at no loss in flexibility. To start, the operator merely sets the throttle, pulls the starter, engages gears and air clutch, and pulls away with the load. Stopping is a matter of brake application, with dynamic breaking through compression providing better control and easier operation. Power application is to all four wheels, preventing slip of either pair. Fine control of torque output and drawbar pull permits operation of the locomotive up to the slipping point of the wheels, and, when increased cohesion is required between drivers and rails, sanding may be resorted to without regarding insulating effects.

Sale of the first locomotive has been made to the Pond Creek Pocahontas Company. The locomotive will be placed in operation at the company's No. 1 mine at Bartley, West Virginia.

Operators platform on the mine diesel locomotive. Note convenient and accesible location of controls.

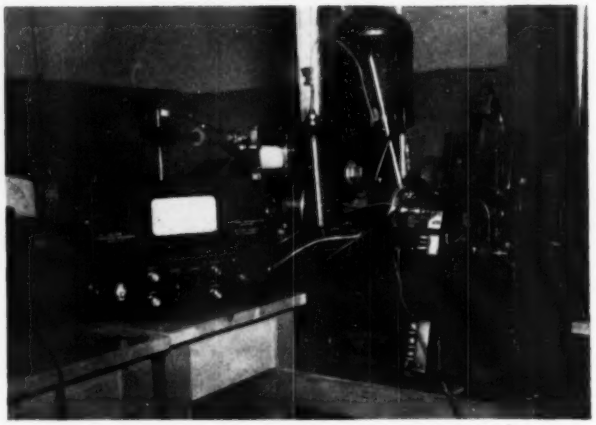


Oil Film Thickness Indicators For Sleeve-Type Bearings

IN studies of engines and engine lubricants, it is often desirable to measure clearances between shafts and sleeve, or journal-type bearings during operation. However, it is usually rather difficult to obtain such measurements without affecting the operation, particularly at high speeds. A method recently developed by M. L. Greenough and associates of the National Bureau of Standards for the Navy Bureau of Ships appears to offer a satisfactory solution of the problem. The heart of the new system is a mutual-inductance type of electrical distance-measuring element; variation of the distance of the rotating shaft from two small fixed coils results in a readily measurable variation in the coupling between the coils.

Development of the gage centered around the problem of measuring film thickness in a 6-in. bearing with a radial clearance (difference in radius of shaft and bearing) of about six thousandths of an inch (6000 microinches). Anticipated maximum rotational speeds were in excess of 10,000 rpm.; hence, the gage was designed to make no physical contact with the shaft. Operation in lubricating oil at a temperature of 200° F was another requirement.

Three successful variations of the device have been developed. The models differ in the type and number of probes used, in sensitivity, in suitability for measuring vibratory conditions, and in type of indicating device. A cathode-ray tube is used with one model to provide a continuous picture of shaft displacement, while the other models give distance indications of a dial or meter. Sensitivity is ample; a distance change of as little as 10 microinches—less than a thousandth of the difference in diameter between shaft and bearing—may be detected. In the cathode-ray-tube model a small displacement of the shaft causes a displacement 150 times as great on the face of the cathode-ray tube, and this is by no means the maximum magnification attainable with the system.



National Bureau of Standards oil film thickness indicator, Model 3, installed on an Amsler-type bearing test machine.

In general, measurement of the distance of the shaft from a single probe will not define the shaft-to-bearing distance at all points, even though the shaft be perfectly rigid. From two to six probes are therefore used in the various NBS models. The probes are fastened rigidly to the bearing under study at various locations just outside the point at which the shaft enters the bearing.

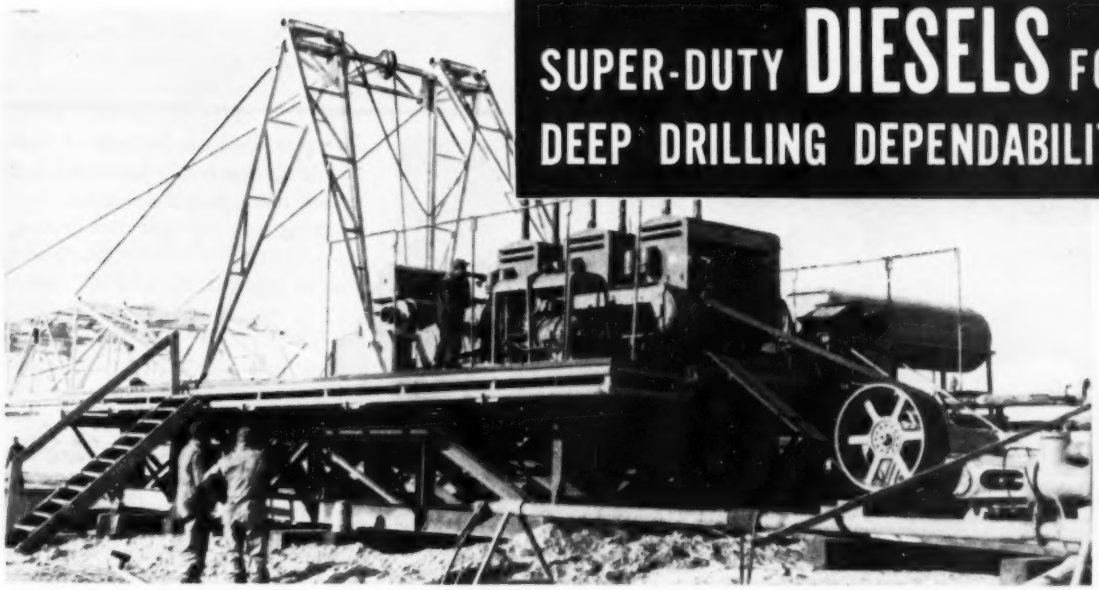
Air-core probes at radio-frequency in conjunction with a cathode-ray tube, are used in one indicator model (Model 1), while iron-core probes at audio frequency are used with voltmeters on the others (Models 3 and 4).

The two types of probe have much in common. Each probe consists of a pair of small coils—a primary and a secondary—mounted close to each other and close to, but not touching, the surface of the shaft. An alternating current applied to the primary induces in the secondary a voltage dependent on the mutual inductance or coupling between coils. Because of the effect of the nearby metal shaft on the electrical field of the coils, the coupling, and hence the output voltage, varies with changes in shaft-to-coil distance. The readily-measurable relation between primary current and secondary voltage is thus an index of shaft-to-coil distance, and indicating instruments may be calibrated in terms of shaft-to-bearing distance.

In the air-core probes, which operate at a frequency of the order of 2.5 megacycles, the coils are concentric and approximately coplanar. The nearby metal shaft acts as a shield: the closer the shaft to the probe, the less the coupling between the coils. This shielding action—and, hence, the sensitivity of the arrangement to changes in distance—is optimum if the metal surface is non-magnetic. For this reason it is desirable, in test installations using the air-core probe, to electroplate the shaft with a thin band of copper centered under the probes.

The coils of the iron-core probes, which are operated at about 2000 cycles, are wound on the legs of a U-shaped form. The nearby steel shaft increases the magnetic flux through the coils; thus, with the iron-core probes, the closer the shaft to the probe the greater the coupling between the coils.

Each of the two types of probe has its advantages and limitations. The iron-core technique is better suited to installations where maximum sensitivity is desired and, furthermore, does not require copper plating of the steel shaft. The radio-frequency air-core probes, on the other hand, make possible accurate observations of high-frequency shaft vibration; these are not possible with the low-frequency iron-core method. The air-core system is also more nearly linear: the input-output ratio is more closely proportional to distance.



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● This is a driller's Diesel. It's full of power—and dishes it out on demand—fast, flexible, and smooth! You'll get the same snappy acceleration with this Waukesha Super-Duty Diesel that a good gas engine gives you. And quick starting, in cold weather, too.

Of all its exclusive Diesel design features—the biggest is the patented combustion chamber. It's the *why* of deep drilling dependability—clean burning, lively acceleration, smooth, shock-free operation, high fuel economy with long life and low maintenance.

Other big features — hardened 7-bearing crankshaft with torsional vibration dampner; wet sleeve cylinders; oil cooled pistons, each with 4 rings, top ring chrome plated; built-in oil cooler; American Bosch injection; either electric or gasoline engine starter; and more, all pictured and described in complete detail, in Bulletins 1415 and 1418. Send for them now.

WAUKESHA *Diesel* OIL FIELD POWER

UNIT RIG (above and below) powered by three **WAUKESHA Super-Duty DIESEL Oil Field Power Units** (Model 6-WAKDU)—six cylinder, 6¼-in. bore x 6½-in. stroke, 1197 cu. in. displ.

WAUKESHA MOTOR COMPANY
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142

New Products

New Truck Diesel

Newest member of the Cummins automotive line is the JBS-600. Developing 150 hp. with only 401 cu. in. of piston displacement, the new engine has been designed primarily for medium-duty trucks, city and inter-city bus applications.

The JBS-600 is a six cylinder, four-cycle, full diesel, weighing 1745 lbs., and develops its rated power at 2500 rpm.

A number of International Model L-190 trucks with these engines have been ordered by the Hercules Powder Co. at Bessemer, Alabama. Shown above with one of the first of the L-190's to be powered with this engine is L. W. Jackson, Motor Maintenance Supervisor, for Hercules. An insulated body will be installed on the truck by the company for the hauling of commercial dynamite.

Overdrive for Fuller Transmission

Incorporation of overdrive in the latest model of the Fuller 10-speed "Roadranger" transmission, to add to the flexibility of this "one lever—no gear splitting" innovation, is announced by the Fuller Manufacturing Company.

By addition of overdrive in the Model R-950-C, Fuller adds a gear ratio of 0.779 to the high range, which incorporates additional ratios ranging from 2.10 to 1.00. The "Roadranger" provides low range ratios of 7.45 in first to 2.76 in fifth. Reverse gear ratios are 9.89 in the low range; 2.70 in high range. It is built, like the non-overdrive R-95-C, in SAE No. 1 and No. 2 clutch housing sizes.

By using helical gears in all forward ratios, maximum power is squeezed into minimum space and weight—the R-950-C weighs only 804 lbs., with standard controls. It requires less space than a conventional transmission and amidship auxiliary.

The unit's 10 selective gear ratios are evenly and progressively spaced; it has shifts in 28 per cent steps; range shifts are pre-selected, automatic and synchronized. With these features it permits the engine to operate in its peak horsepower range with resulting higher road speed and fuel economy; reduces shifting by one-third to lessen operator fatigue.

New Battery Resists Heat, Cold

A new light-weight storage battery which will start a car at 65° below zero has been developed at the University of Michigan Engineering Research Institute under the sponsorship of the United States Army Ordinance Corps.

The new battery is expected to have wide use commercially as well as mili tary application. Utilizing a new principle in the construction of the grids, and successfully lead-plating materials ordinarily corroded by sulfuric acid, such as aluminum, brass or iron, large savings of lead can be realized. Using these materials results in a much lighter and more powerful battery.

Owing to the low self-discharge rate, cars can be idle for long periods without experiencing a "dead" battery.

Heli-Coil Increases Line

Four new small-size stainless steel helical-wire thread inserts, for strengthening tapped thread in aluminum, magnesium, plastic, iron, steel, brass, bronze and wooden components, are available from the Heli-Coil Corporation.

These new sizes, extending the use of the thread inserts in small holes, include 8-36 and 6-40 sizes in the fine thread series, 5-40 and 4-40 sizes in the coarse thread series and are available in 1, 1½, and 2 in. diameter lengths.

Helical wire thread inserts have three industrial applications. They are used as original manufacturing components in new equipment. They are also used in production salvage operations—to repair threads damaged during manufacture and in maintenance operations—to repair thread damaged during prolonged use.

Differential Converter

Increased demands for an instrument to measure and control flow has prompted the Brown Instrument division of Minneapolis-Honeywell to develop a differential converter.

Operation of the Differential Converter is based upon the accurate and sensitive pneumatic-balance principle, wherein the force of the differential pressure across the flow orifice—or from any other source—is opposed by the force of air pressure acting in a weigh beam system similar to that found in analytical balances. Air pressure developed to balance the force thereby becomes a measure of the differential pressure or flow, and is transmitted by a single air line to a pneumatic receiving instrument which can be any type of indicator, recorder, or controller.

Located close to the orifice, or other source of pressure, the converter rapidly detects every change in the variable, transmitting this measurement over distances up to 1,000 feet. A controller, however, can be located close by for minimum delay in the operation of a control valve.

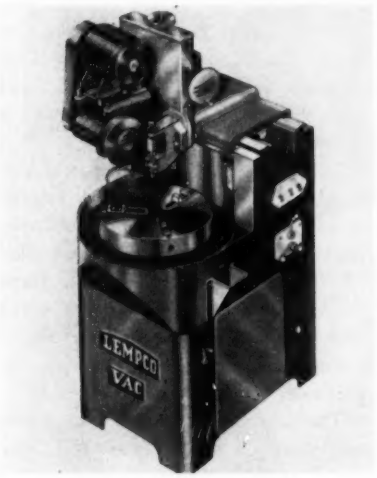
Multiple Head Tachometer

A new tachometer monitor known as the 42R has been developed by the Metron Instrument Company. With this device it is possible to measure the speeds of any of 2 to 10 remotely located machines at one convenient location. Working in conjunction with a Metron tachometer head which is placed on the machine the indicator can be placed as far away as 1000 ft.

Vertical Clutch Plate Grinder

Lempco Products, Inc. is now manufacturing a new vertical clutch plate and flywheel grinder that permits the operator to place the work on a vertical chuck.

The product has a 25½-in. swing, said to be capable of mounting some of the largest clutch plates and flywheels now in use. The turning and grinding are simultaneous with the tool and wheel moving across the face of the work powered by an automatic hydraulic feed.



In addition to its use in the automotive shop, it can serve as a vertical lathe for turning short work pieces of comparatively large diameter and can grind flat surfaces such as dies up to 18 by 18 in.

Deep Sockets for ¼ In. Drive

Bonney Forge & Tool Works announces the addition of a new series of ¼-in. drive, 2-in. deep, bolt-clearance sockets. These sockets are precision made, thin-walled and sturdy, eliminating the need for a short extension in hard-to-get-at adjustments.

While these sockets will service many applications, they are especially suited for ignition, carburetor, radio, dash board and interior work on cars and trucks.

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interchangeable parts—
lower maintenance costs
Even the heaviest parts of every FULTON DIESEL are craftsman-machined to such close tolerances that they are completely interchangeable. Result:
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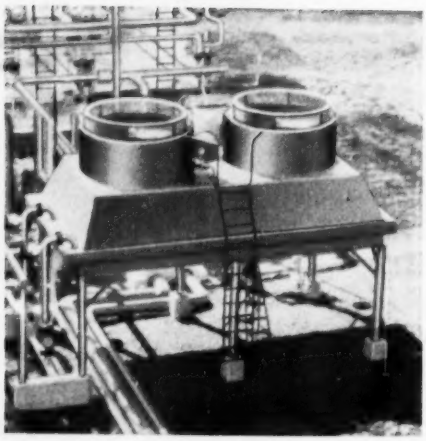

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Air Cooled

Heat Exchanger

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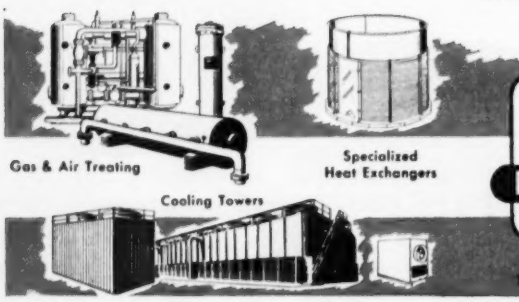

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This series of sockets is available either singly or in a set of eight progressive sizes,—3/16, 7/32, 1/4, 9/32, 5/16, 11/32, 3/8 and 7/16.

Compact Gasoline Filter

A new gasoline filter manufactured by Sparkler Manufacturing Company is said to overcome many disadvantages of standard model filters by being exceptionally light in weight and small in size.

Designated the Rayclean Model MB, the new filter has a cast aluminum top and strong aluminum alloy bowl, yet when completely assembled it weighs only 3¼ ounces, including the entire filtering element—light enough to be supported by the fuel line alone.

Filtration is by means of a special non-woven rayon cloth which covers each filter disc. Due to the physical properties of the cloth, it is claimed that fibers cannot come loose, as so often happens with other types of media, and clog the carburetor's needle valve, it is claimed.

High Pressure Filter

High pressure oil filters for filtering lubricating and sealing oil on

centrifugal gas compressors and oil pumps on pipelines and other applications for working pressures up to 1500 lbs. have been introduced by the Hilliard Corporation.

Oil enters the inlet and is forced through a filter cartridge which is made of fuller's earth or cellulose. The filtered oil passes to the oil seal or supply tank as required. Clean oil free of solid and abrasive matter protects against scouring of bearings and mechanical seals. The high pressure filters are available in capacities starting at 1 gpm. to practically any flow required.

New Electrical Insulation

Johns-Manville is now offering "Quinterra Type 3", an asbestos-base, silicone-treated, high temperature electrical insulation. It is a Class H insulation, as defined by A.I.E.E. standards, for service at a temperature of 180 C.

Used for both inter-layer and wire wrapping insulation, the new product is adaptable to a wide range of electrical devices including air cooled, inert gas, and silicone filled transformers. Some of the advantages it offers are savings on materials, a greater factor of safety and the opportunity for more compact design.

The insulation maintains a dielectric strength of at least 350 vpm. under continuous exposure to Class H maximum temperature of 180 C. Furthermore, this dielectric strength remains practically constant even under continuously high humidity since the insulation has high moisture resistance.

Heavy Duty Lube Oil

A new series of heavy duty engine oils, Ursa Oil X Sup. One 10, 20, 30, 40 and 50, has been marketed by The Texas Company for the lubrication of heavy duty gasoline engines and automotive-type diesel engines which are operated under adverse conditions.

Among the factors contributing to the increase in the severity of lubricating requirements in certain types of these engines are design changes, use of a wide variety of fuels, and use of high sulfur content diesel fuels. Increased engine deposits and greater wear have resulted from the use of such fuels, with other oils.

The new Ursa X Sup. One series was developed by the company's research laboratories to provide a heavy duty lubricant for application wherever an oil meeting the requirements of U. S. Army Specification 2-104B, Supplemental List No. 1, is desired.

Laboratory and field tests revealed that this lubricant provides the extra protection now required in severe but unsupercharged heavy duty engine service. It delivers satisfactory protection in service employing diesel fuels up to 1.0 per cent, or higher, sulfur content.

Economy was a primary concern in the development of the new oil which incorporates certain characteristics required in heavy duty engine lubrication without going to heavy duty engine oil cost.

Alloy with Many Uses

A new alloy with a wide variety of uses has recently been announced by Chemalloy Associates. The alloy is composed of metals and chemicals produced by bringing together an alloy of molten metal plus an alloying of a wet chemical mass.

According to the manufacturer, the new product resists rust and corrosion, works without lubricants in moving machines or parts, remains cool while being machined, is readily applicable to die-casting and holds tolerances normally associated with machining operations, has been successfully used to weld aluminum without the use of a flux, and can be resonably produced.

Properties of Chemalloy can be changed to meet the requirements of the customer. A typical sample would have a tensile strength of about 50,000 psi. and a Brinell hardness of 92.

New Anti-Rust Paint

A new penetrating and sealing antirust paint, known as PCA-100, which can be applied right over rusted surfaces, was recently announced by the Paint Corporation of America.

Suitable for both interior and exterior use, the new paint is reputed to be equally effective in preventing rust on new metal or stopping rust action on present rusted metal. According to the manufacturer, PCA-100 can be applied right over rust without extensive surface preparation such as wire brushing, scraping or sand blasting. Upon application, it penetrates through the rust layer into the base metal and seals the surface against further rusting. The paint is suitable for either brush or spray application.

another New
HONAN-CRANE
OIL PURIFIER
for Another
New Diesel
A typical illustration of sound preventive maintenance. This Honan-Crane Purifier, installed with Rensselaer's new 2800 HP Nordberg Diesel, maintains lube oil in "new-oil" condition . . . keeps vital engine parts clean and free from damaging abrasives, acids, sludge and other oil contaminants.
time-tested performance
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The diesel-operated Municipal Plant at Rensselaer, Indiana, installed its first Honan-Crane Oil Purifier in 1941. In continuous service for the past ten years and still going strong, this unit has paid for itself many times over by maintaining diesel lube oil in a clean, safe condition . . . protecting generating equipment from costly shutdowns and repairs. That's why Rensselaer, like other Honan-Crane users, specifies Honan-Crane for all new equipment.
Write today for "The Facts About Clean Oil." Tells how plants, large and small, reduce operating costs, improve plant efficiency with sound Oil Purification programs.
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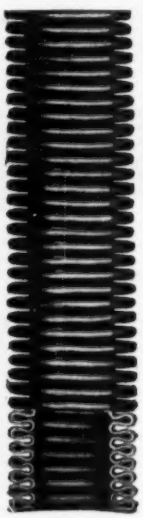
You can do that with ATLANTIC seamless diesel hose which requires no maintenance whatever.

Absolute uniformity of wall thickness . . . no seams or packed joints . . . absolutely tight against water, oil, steam, gas, air . . . dampens vibration . . . . maintains flexibility at extremely high temperatures.

Bronze, Steel, Stainless Steel, Monel — ⅛"—36" I.D. with fittings as needed.



Diesel Bulletins 1020 & 50A furnish complete information.

See our Catalog in Sweet's File for Product Designers.

ATLANTIC

109 West 64th St., New York 23, N. Y.

PCA-100 is furnished in black only and, due to its penetrating characteristics, should be used solely as a "finish" coat. A companion product, PCA101 is a clear paint, equally effective for rust prevention, and can be painted over with any standard paint of any color.

New Air Grinder

A new air grinder, giving 20 per cent more power than previous models has been announced by Ingersoll-Rand. It has an added safety device to prevent overspeed operation and possible accidents and has special application in foundries, steel mills, general manufacturing and metal working plants where hand grinding is required for snagging, trimming, smoothing, etc.

The new grinder contains a motor governor unit called the "overspeed safety coupling". In case the motor overspeeds because of governor wear, abuse, maladjustment or dirty air, the "overspeed safety coupling" automatically uncouples the arbor and the grinding wheel from the motor, making it impossible to operate the grinder until the cause of overspeeding has been corrected.

Another safety feature of the grinder is a multiple exhaust system. The operator can choose any one of four exhaust positions, spaced 90 degrees apart, and thus direct the exhaust away from the work and from his own body, if he desires. Special muffling reduces the exhaust noise to one-tenth of the previous models.

A new type rubber-faced throttle valve is unaffected by oil or moisture and seats better, under all conditions, than the beveled-face steel type valve. Replacement, if ever needed, is easy and economical, and no lapping is necessary.

New Spotlight

A powerful, new outdoor spotlight, providing 100,000 candlepower with only a 300-watt rating has been announced by Stonco Electric Products Company. The new unit is designed to concentrate its entire light output in a long-throw, oval-shaped, narrow floodlighting beam that is recommended for area protection lighting of such vulnerable spots as railway sidings, switch and loading areas, shipyards, docks, air terminals, service stations and other industrial properties.

Made of non-corrosive, heavy-duty cast aluminum throughout, the Stonco No. 56 spotlight has a universally adjustable cast-aluminum swivel arm threaded ½ in. NPT to fit a variety of standard interchangeable accessories. Up to five units can be mounted to a single cluster light assembly so that in antisabotage lighting in particular, all lights in a cluster would have to go out before total darkness is possible.

New Literature

Insulation Booklet

The Pittsburgh Corning Corporation has announced the availability of a new booklet entitled "Foamglas Insulation for Piping and Process Equipment". This illustrated 24-page booklet gives the properties of Foamglas, plus data for cold, intermediate and hot applications, details for insulating tanks, ducts, removable covers, and tank heads, accessory materials, and prominent users, and distributors.

Tables show sizes and shapes of the product available in pipe insulation, standard blocks, beveled lags, and standard curved segments, and recommended shapes and thicknesses.

Governor Brochure

The Pierce Governor Company, Inc., has released a new booklet, "How to Get the Most out of Your Governor".

Illustrated with photographs and schematic drawing, the new booklet describes the operation of the governing mechanisms, and explains with the use of charts, governor weight energies and calibrations.

Included are discussions on valve boxes, valve shafts and linkages, positioning of governor levers and geometry of connections; causes and effects of engine condition on governor efficiency. Details on governor adjustment, care and maintenance, along with a description of basic type Pierce governors and their uses, are also included.

Snap-on Tools Catalog

Snap-on Tools Corporation, has recently completed a new catalog covering their complete line of over 4000 tools. This catalog contains 104 pages of all types of socket wrench equipment, hand tools and wrenches, punches, chisels, screwdrivers, pliers, and other related tools and equipment.

Large illustrations of all types of wrenches with copy keyed to them for easy identification is a feature. Complete specifications of all tools are included.

Paint Bulletin

A new bulletin descriptive of its complete line of heat-resistant paints is announced by Speco, Inc.

This bulletin gives application and product data for five heat-resistant paints — standard aluminum, extra high heat aluminum, aluminum for moderately hot surfaces, hot surface elastic black, and quick drying black.

I-H Research Booklet

A new 12-page booklet entitled "Organized Curiosity, Inc." has been released by International Harvester Company.

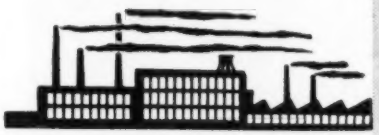
The booklet is a picture story of the company's 290-man research team checking products for quality from design to delivery in the manufacturing research department in Chicago.

Air Cylinder Catalog

Twenty-eight different models of air cylinders, each in nine bore diameters, are illustrated and described in the new catalog section No. 55, published by Rivett Lathe & Grinder, Inc.

Working drawings and specifications are furnished for each model and size cylinder, both standard and cushioned types, single and double end rod, internal and external threads. Information relative to a particular model is all shown on one page, facilitating easier layout of circuits by the engineer. Cylinder mountings described are rabbet, foot, trunnion center line, blind end flange, rod end flange, and clevis. They are recommended for air pressures of 150 psi. maximum, and oil pressure of 300 psi. maximum.

Like having a tool store right at your door!



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Ever needed tools *fast?* What plant hasn't? To meet just such emergencies—as well as the year-'round normal tool needs of all Industry—Snap-on maintains the 41 factory branch warehouses listed here. The complete Snap-on line offers more than 4000 tools for industrial production and maintenance. Snap-on factory branches make them quickly available to factories and shops everywhere. Snap-on branches are staffed with tool specialists experienced in the needs of industry. A phone call brings Snap-on service right to your door . . . *try it!* For latest Snap-on Industrial and General Catalog, write—

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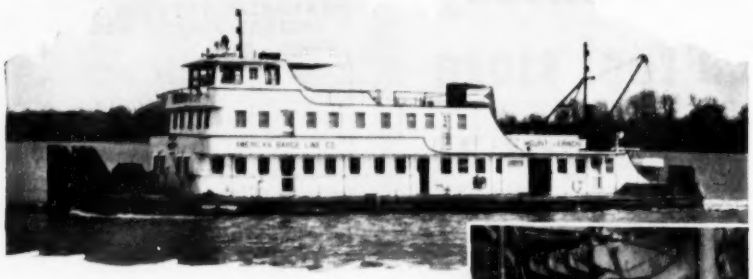


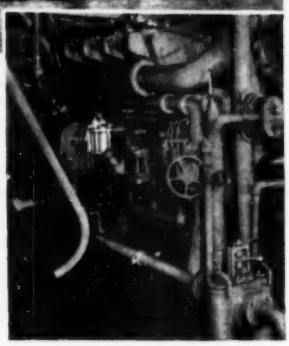
NUGENT FILTERS for fuel and lube oil

The amount of protection afforded by fuel and lube oil filters is dependent upon the effectiveness of the filters... and all filters are not equally effective. You'll see what we mean if you'll compare Nugent Filters with any others. By actual test, Nugent Absorbent Oil Filters remove 99.8% of the dirt. Dirt and carbon particles as small as a few microns are removed and prevented from getting to those areas where they can accelerate wear and shorten engine life.

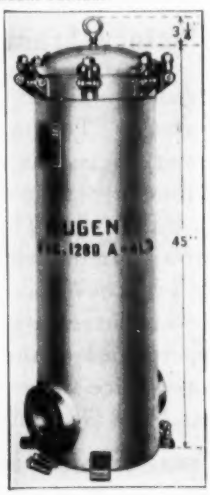
Size for size, Nugent Filters offer greater filtering area. In addition, they make possible a choice of full flow or by-pass filtering with the same unit. Recharges are inexpensive and easy to install. Simple piping makes installation no problem.

Write for descriptive literature that shows how to insure the long life of your diesel.

Three 720 H. P. Cooper—Bessemer Diesel powering the American Barge Line Company's new "Mount Vernon", illustrated above, are equipped with Nugent Filters for fuel and lube oil, helping to assure the owners that they will get all the fine service these engines are designed to give.



Above—One of the Nugent Duplex Fuel Oil Filters installed on the "Mount Vernon." Below—A Nugent Lubricating Oil Filter of the type used on the "Mount Vernon."



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Representatives in Boston • Cincinnati • Detroit • Houston • La Jolla, Calif. • Los Angeles • Minneapolis • New Orleans • New York • Philadelphia • Portland, Ore. • San Francisco • Seattle • St. Louis • Tulsa • Representatives in Canada: Montreal • Toronto • Vancouver

Ace Drill Bushing Handbook

A new reference handbook has been released by the Ace Drill Bushing Company.

The handbook serves as a catalog for the company, and also includes copyrighted comparison tables. These provide cross reference to some 3023 symbols used by other leading manufacturers. These tables compare their many symbols to actual A.S.A. Standard sizes and specifications as used by Ace.

Excavator Catalog

Marion Power Shovel Company has published a new bulletin on their "all-purpose excavators".

The 2-color, 32-page booklet, lists condensed specifications and types of service to which the machines can be converted for use, as shovel, dragline, clamshell, crane, backhoe, pile driver, or coal loader and gives crane lifting capacities.

Motor Grader Operator's Handbook

Caterpillar Tractor Company has issued a Motor Grader Operator's handbook.

The handbook features an attractive cartoon type presentation, illustrating the various parts and operation of the grader.

Chain Belt Bulletin

Chain Belt Company has released a new bulletin on Rex belt conveyor idlers and machinery. It contains information on all of the latest designs and developments of this equipment. There are two pages of general engineering information to help in designing and specifying belt idler equipment.

Information on the new Rex return belt training idler is given, together with material on the newly developed steep-angle troughed belt idlers and steep-angle troughed belt training idlers. Latest data on lubrication material and techniques is included.

A detailed description of zipper bunker seals is included, plus data on belt conveyor trippers. A section contains information on maintenance procedure.

"Cat" Service Booklet

A 12-page booklet, recently issued by Caterpiller Tractor Company, stresses the importance of service to equipment owners.

There are ample illustrations of "Cat" service facilities, special tools and fixtures and conservation practices.

Giddings & Lewis Bulletins

Giddings & Lewis Machine Tool Company has ready individual bulletins on three new horizontal boring, drilling and milling machines, one bulletin on their new 54 in. to 6 ft. heavy *Hypro* vertical boring and turning mill and also a 2-page bulletin describing accessories and attachments for horizontal boring machines. Information contained in each booklet tells how the equipment can be used to solve various production problems.

Drill Press Handbook

A new manual for shop men, "How to Run a Drill Press", has been published by the South Bend Lathe Works. It is devoted exclusively to the small, sensitive type drill press.

The section covering care, operation, and maintenance includes illustrations giving the name and function of all important parts and correct adjustments of each unit. Best method for mounting and removing chucks and tools are explained as practices for laying out and setting up work. Although intended primarily for metal working shops, the book includes many special classes of work including boring and sanding wood parts, drilling through glass, polishing and buffing, etc.

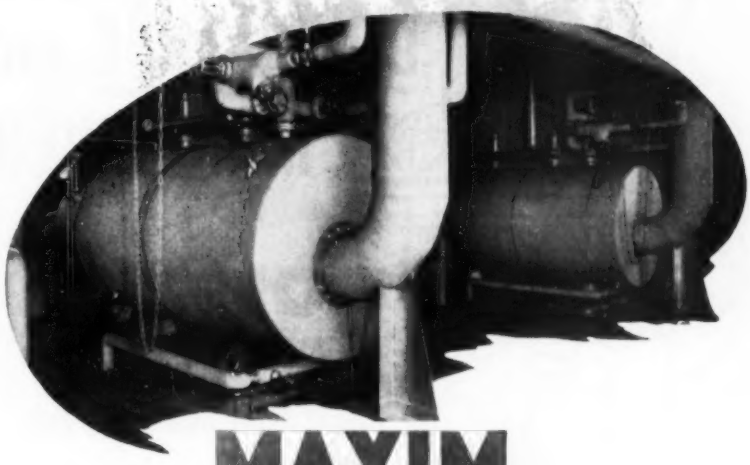
The handbook contains 32 pages and more than 75 illustrations.

"Heat Treat Review"

The second number of the "Heat Treat Review", published by Surface Combustion Corporation, has been printed recently and is being distributed to those concerned with the field of metals heat treatment.

A feature of this 8-page issue is an article on gas carborizing furnaces, their design and operation, giv-

IS WASTE HEAT WASTING YOUR MONEY?



MAXIM

HEAT RECOVERY SILENCERS CONVERT WASTE EXHAUST HEAT TO USABLE STEAM or HOT WATER

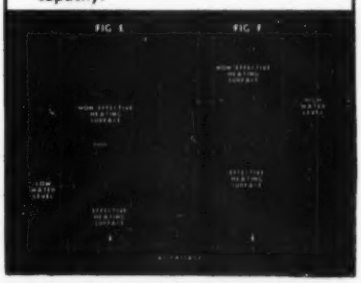
A big Los Angeles Sewage Disposal Plant found that Maxim Heat Recovery Silencers provided all the steam necessary for plant heating as well as heating the sludge — *and from exhaust heat that would otherwise have been wasted.*

Perhaps your own operating expense picture can be improved by this simple and effective way to provide extra steam or hot water for heating or processing operations while at the same time effectively silencing exhaust noise. Our engineering department will be glad to make recommendations.

Automatic Controls

In figure E water is low and there is less effective heating surface (heating surface in contact with water), hence lower steaming rate.

In figure F water is high and gives greater effective heating surface — higher steaming rate. Steam pressure regulated valves control the amount of water to produce desired steam capacity.



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Gentlemen: Please send me your Bulletin on Heat Recovery Silencers

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THIS QUICK-CHANGE HEAD REALLY SAVES DOWN TIME and MANPOWER

HOFFMAN FILTERS

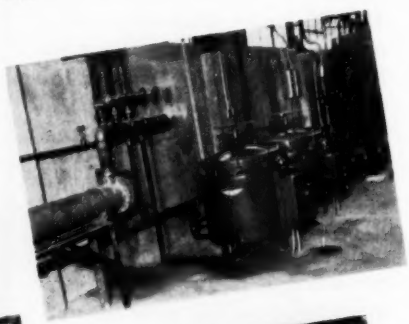
for Diesel Fuel and Lube Oils

Simply back off the swing-bolts — turn a hand-wheel, and the cover of your Hoffman Cartridge Filter lifts and turns aside for fast, convenient cartridge changes!

Hoffman builds two series of cartridge filters. One employs Navy 7x18 throwaway units; the other uses 11x18 cartridges, either throwaway or repackable type. Both series provide efficient, dependable removal of contaminants from fuel and lubricating oils — for low cost.

WRITE FOR BULLETINS

Full descriptions and specifications are contained in Bulletins A-649 and A-703. Write for them. Illustrated here are three typical Diesel installations protected by Hoffman filters. Get the facts for your requirements.



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ing actual data as gathered in the field. An editorial on depreciation allowances defines industrial problems in this activity and suggests means for alleviating same. Continuous heat treating of automotive forgings at Nash Motors and high speed heating of forged automobile knuckle spindle supports at Ford Motor are also described. Drawing, graphs and photographs are used to illustrate these articles.

Cummins Leaflet

Operating data compiled by the Bureau of Mines at National Lead Company ilmenite-magnetic mine, Tahawus, N. Y., on 17 Cummins diesel powered haulage trucks was used in the preparation of a four-page leaflet entitled, "Low Cost Ore Haulage With Cummins Diesels". The leaflet is illustrated with charts and photographs.

Aeroquip Industrial Catalog

The new Aeroquip Industrial Catalog has recently been completed. In addition to giving complete information about industrial products, it contains information on how to order parts and the construction and principles of hose lines and detachable, reusable fittings.

The catalog has a loose leaf arrangement which permits users to order additional catalogs consisting of selected pages.

LPG Fire Control Booklet

Socony-Vacuum Oil Company has released a booklet for firemen and others who are sometimes called upon in emergencies in which liquefied petroleum gas is involved.

The booklet points out procedures and recommended methods of handling LPG in such emergencies.

Bendix Bulletin

A 40-page bulletin recently issued by the Bendix Aviation Corporation lists the different products supplied by the corporation. It also contains descriptions and illustrations of principal products and services, as well as information covering the manufacturing facilities of the firm's divisions and subsidiaries.

Furnace Bulletin

An illustrated bulletin describing the complete line of standard rated furnaces for tool room heat treat requirements is now available from Surface Combustion Corporation. Emphasizing methods of precise heat treatment for tool life, it describes controlled atmosphere furnaces and generators in addition to direct-fired, forced convection and pot furnaces.

The back page contains a hardness conversion table for reference in tool room and laboratory.

Nickel Welding Booklet

A new technical booklet on the resistance welding of nickel and high nickel alloys has been issued by the Development and Research Division of The International Nickel Company, Inc. Designated as technical bulletin T-33, it contains 32 pages illustrated by drawings and photographs. It also presents tables on mechanical properties, chemical compositions, recommended conditions for welding and other information.

Morse Chain Catalog

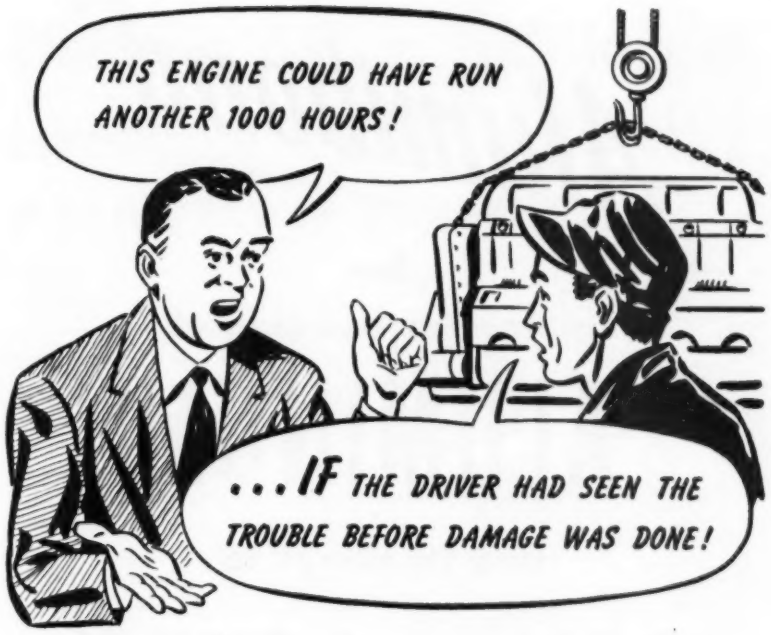
A new catalog of stock roller chains and sprockets has recently been announced by Morse Chain Company.

The catalog gives details on list prices, available sizes of types A, B, and C stock sprockets, and pertinent information on roller chains from $\frac{3}{8}$ in. pitch to 2 in. pitch. Also included are data on drive selection, service factors, installation, and service.

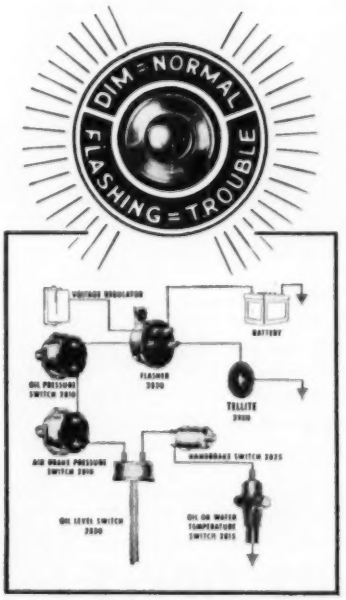
Accident Prevention Manual

Practical ways to prevent industrial accidents and fires are contained in the new edition of the National Safety Council's 800-page "Accident Prevention Manual for Industrial Operations." The book is confined principally to safety in the manufacturing industry, and is based on the premise that a major proportion of all accident causes are common to all industry.

Subjects covered include plant layout, maintenance, boilers, pressure vessels, machine guards, materials-handling hazards; hand and portable power tools; welding and cutting, electrical hazards; flammable liquids, etc.



TELLITE flashes a clear bright signal whenever failure occurs in



OIL PRESSURE
OIL TEMPERATURE
WATER TEMPERATURE
GENERATOR OUTPUT

A pilot light glows dimly when conditions are normal . . . flashes brilliantly the instant trouble begins—before costly damage is done.

TELLITE is low in cost and economical to install. Write today for full details. Rochester Manufacturing Co., Inc., 34 Rockwood St., Rochester 10, New York.

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molecular bonding of

ALUMINUM

and its alloys to

IRON and STEEL

and their alloys provides

1. LIGHTWEIGHT combining the lightness of aluminum and the strength of steel or iron and taking advantage of the machinability of aluminum.

2. HEAT DISSIPATION.

3. BEARING PROPERTIES.

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APPLICATIONS

Bearings • Heat Exchangers • Large Diesel Pistons • Corrosion Resistance • Rotors Radio-Anode Tubes • Brake Drums • Cooling Cylinder Fins • Housings • Gears • Bi-Metallic Assemblies • Oil Refinery Parts • Textile Machinery • Bag Making Machinery • Heat Dissipation Units

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"Engines Today"

The Internal Combustion Engine Institute has published a booklet entitled "Engines Today".

This eight-page booklet discusses the internal combustion engine's place in today's civilization, production and service facilities, and applications. The closing section covers the history of the Institute as well as requirements for membership.

Cooper-Bessemer Bulletin

A new comprehensive bulletin describing its type FV diesel engines has recently been announced by The Cooper-Bessemer Corporation. It gives complete engineering data, specifications and power ratings.

Built in 6-, 8-, 12-, and 16-cyl. types, the FV engines are currently used for locomotive service, draglines and electric power generation in industrial plants.

Vapor Degreasing Handbook

A new 21 page handbook on vapor degreasing of metal parts has been published by the Phillips Manufacturing Company. It answers most questions generally asked about vapor degreasing, completely covering the subject of what it is and to what types of materials and manufacturing it can be applied. Numerous photographs of various types of units along with useful data charges are also included in the booklet.

Kent-Moore Tool Guide

A new special service tool guide for General Motors diesel engines has been published by Kent-Moore Organization, Inc. The 36-page guide covers special tools for servicing the Series 71 and 6-110 G. M. diesel engines, G. M. rail car transmissions, industrial power transmission units using the Series 71 engine, and torque converters used with the Series 71 and 6-110 engines.

The guide contains descriptions, illustrations, model applications, tool numbers and prices of more than 150 special purpose service tools for the above G. M. diesel applications, along with a section devoted to special heavy duty repair shop equipment required for servicing G. M. diesel engines.

Experimental High Speed Cummins Engine

(Continued from page 40)

tending to seat the rings in the grooves. Changing to 1/8-in. wide compression rings gave the advantage of less mass, better conformability to the cylinder liner, lower unit contact and better gas sealing. This solved the problem.

A remaining problem is ring groove wear at high speed. Ring faces showed considerable wear, but the major concern is a piston problem; groove wear and pounding, particularly in the top ring groove. However, high speed did not introduce this problem, only magnified it. This disadvantage is far outweighed by the superior ability of the keystone ring to remain free in high output engines.

Cylinder Clearances — To eliminate piston scuffing and seizure, it was found necessary to increase piston-to-liner clearance from the normal 0.0055 in. to 0.0095 in. There was no measurable change in power output, oil control or blow-by with this change. Combined with our usual scuff resisting, knurled skirt pistons this added clearance was effective in preventing piston seizure.

Summary

Throughout this experimental program, much detail was involved in each of the items discussed. Also, many other matters of lesser importance required attention. The "highlights" have been given with the intent of presenting a general and overall picture of what we observed in our high speed venture. We feel that we obtained our objectives as stated earlier and answers to our principal questions.

It should be emphasized that there are no plans for production of the engine as described. The program did not produce a saleable engine. Rather, it charted the path for the step by step climb to higher diesel power and higher specific output. It showed that higher speed diesel engines can be run with production materials and without gadgets and special devices. The program, though experimental, was practical in every respect.

Wherever AIR or GAS is used Investigate STANDARDAIRE

AXIAL FLOW BLOWERS

READ STANDARD'S engineered-for-production program has resulted in the acceptance of Standardaire Blowers for virtually every important industry. Blowers are currently being produced for a wide range of applications in a rapidly expanding market — and in many instances to suit specific requirements and specifications. The amazing acceptance of Standardaire Blowers is indicative of their superior operating characteristics, high efficiency and dependable performance in round-the-clock service. For further details we invite you to consult with our engineers. They will be glad to study your air or gas problems and make recommendations. Write Dept. E48

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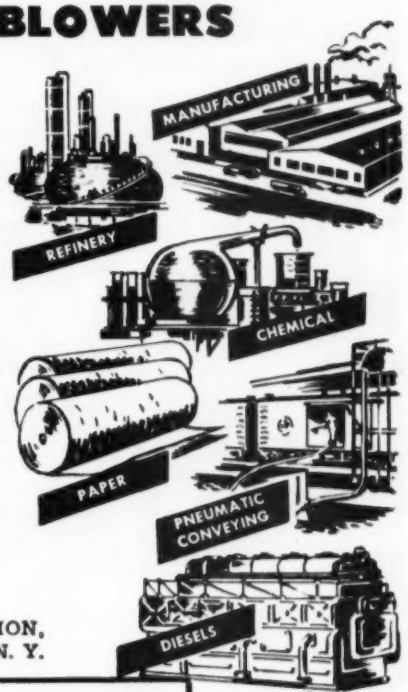
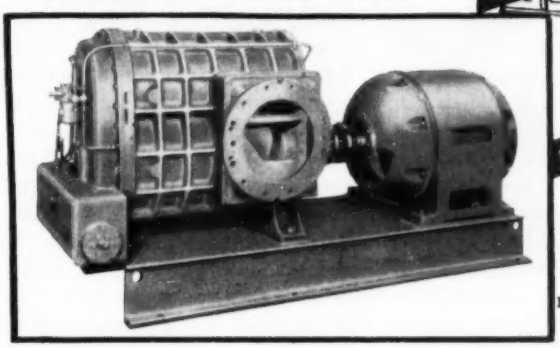
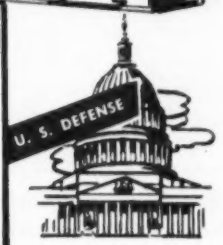
370 Lexington Ave., New York 17, N. Y.







Standardaire 1218B23 Blower to deliver 2850 c.f.m. at 1160 r.p.m.

Engineers like the STANDARDAIRE principle

RECENT BLOWER USERS: Amalgamated Sugar Company • Brillo Manufacturing Co., Inc. • Chicago Pump Co. • Cleaver-Brooks Company • Dow Chemical of Canada, Ltd. • E. I. DuPont de Nemours & Co. • Fairbanks, Morse & Company • Hercules Powder Co., Inc. • Hills Bros. Coffee, Inc. • Husky Oil Co. • Koppers Company, Inc. Monsanto Chemical • National Advisory Committee for Aeronautics • Ozark-Mahoning Co. • United States Navy • Standard Brands, Inc. • West Jersey Paper Manufacturing Co.

BLOWER-STOKER DIVISION

FORMERLY The Standard Stoker Co., Inc.
ONLY THE NAME IS CHANGED

READ STANDARD CORPORATION

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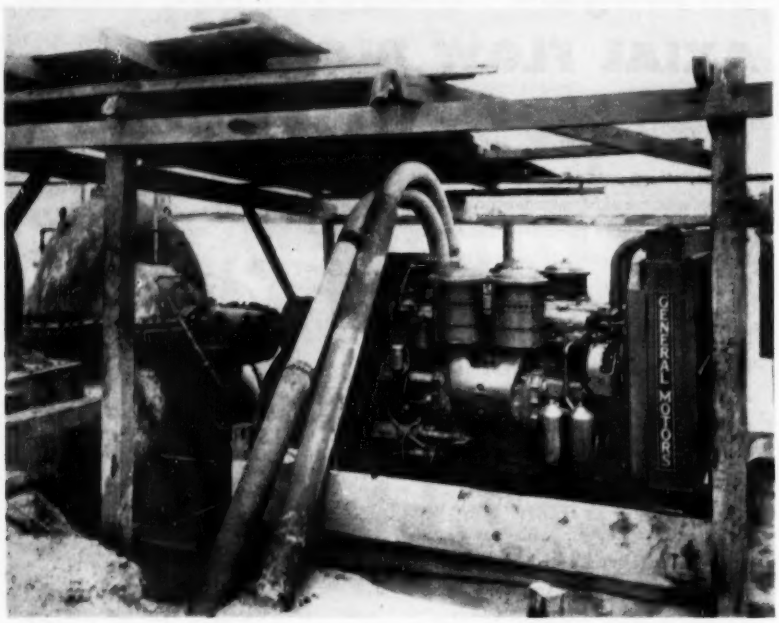
Field Notes



Pumping Operation Salvages Farmland

Pumping day and night to remove 12 to 14 ft. of water from 5500 acres of fertile land, farmers near Antioch, Cal. are racing against time to get the acreage pumped, dried, and leveled in time for next years planting. The area was flooded last winter when river waters broke through a levee. Now that the levee has been repaired, the water is being pumped back over the levee by five 36-in. discharge pumps, each of which delivers about 35,000 gpm. or a total delivery of 175,000 gpm. This operation has been going on since May 15, 1951.

Contractor on the job is the Hild Electric and Manufacturing Co. of Stockton, who called upon Moore Equipment Co., Inc., also of Stockton, to provide diesel power for one of the Byron-Jackson pumps, supplementing the work of four similar electrically-powered pumps. A General Motors "Twin-6" diesel engine was installed on the giant pump and has been running continuously since the project started, with time off only for oil and filter changes. It is estimated that the job will be completed successfully early this fall.

New York Central Adds Diesels

The New York Central announced recently that it has inaugurated the use of diesel-electric locomotives in local passenger service on its West Shore (River Division) line. Two road passenger diesels began the service operated on trains between Weehawken, N. J. and Newburgh, N. Y., and between Weehawken and West Haverstraw, N. Y. These two diesels presage complete dieselization of the West Shore's passenger service in 1952.

Diesel-electric locomotives in yard switching service at several points and on some freight trains have already been placed in operation on the West Shore.

The two new locomotives of 1600 hp. each were built by the American Locomotive Company at Schenectady. Additional diesels of this type eventually will replace the 22 steam locomotives which are now in service.

Casting Research

The Office of Technical Services of the Department of Commerce announced recently that navy researchers, hunting ways to make better metal castings, photographically "shadowed" the molten metal as it flowed through the channels in a mold. They thus learned to arrange the channels so as to produce smooth metal, the key to better castings.

The gating systems (connecting pipes that lead metal into the casting mold) have previously been designed on the assumption that the metal will flow where open channels existed. The Navy investigation showed that, contrary to this assumption, metal flowing freely in a channel may continue along preferential straight linepaths, ignoring side channels and openings. This investigation also showed that producing suitable enlargements at some point in the channels and suitable restrictions at others, would result in uniform metal flow into all cavities of the mold, producing sound castings.

Inventor Awarded Medal

The Franklin Institute has awarded the George R. Henderson Medal to Herman Lemp for his contributions to the development of the diesel electric locomotive. Formal presentation of the award will take place on October 17 at special ceremonies in Franklin Hall, at which a number of other honors will be presented to distinguished scientists of the United States and Europe.

The Henderson Medal, founded in 1924, is given for meritorious inventions or discoveries in the field of railway engineering. The award to Mr. Lemp was given "in view of his basic contributions to the electric transmission through field control, thereby improving the performance characteristics and engine loading of diesel electric locomotives".

Mr. Lemp, a naturalized citizen of the United States, was born in Berne, Switzerland. He was for many years affiliated with the General Electric Company and it was with them that he developed the electrical transmis-

sion for the diesel electric locomotive. He later became chief engineer for the Erie Steam Shovel Company and then consulting engineer of the Locomotive Department of the Ingersoll Rand Company. From 1938 to 1940 he was engaged in railroad building for the New York World's Fair. He is an extremely versatile inventor of some 200 inventions pertaining to electrical control apparatus and engine governor control.

Boron to Replace Critical Alloys

Boron may prove to be the answer to our critical shortage of some alloying materials, according to the NPA.

Boron's chief characteristic is its ability to make steel hard and tough. It is expected to be used as a substitute for nickel, chromium, vanadium, and molybdenum, all of which are scarce.

Steelmakers have found that boron steels can be used successfully in shafts, gears, bearings, machine tools, axles, and armor plate. An increased number of products are expected as metallurgical techniques improve.

At the present time boron steel, in addition to being hard, can withstand very high temperatures, but due to a brittle quality it is doubtful that it will stand up under a combination of temperature and mechanical strain. In addition, it is not expected to be useful in resistance to corrosion.

Locomotive Maintenance Officers' Annual Meeting

The Locomotive Maintenance Officers' Association will hold their annual meeting at the Hotel Sherman in Chicago, September 17-19, inclusive.

The meeting this year as always is devoted to the improvement of service for all railroads, and will bring together the leading men in the industry on what have been considered the outstanding problems on diesel and steam locomotive maintenance problems for the year 1951.

Some of the subjects to be discussed are "Winterization of Diesel-Electric Locomotives", "Water and Oil Leaks", "Air Filters", "Extending Various Inspection Periods", "Diesel Truck Maintenance", "Welding on Diesel Engines", "Reclamation of Diesel-Electric Parts", "Cleaning and Testing Traction Motors, Main Generators, and Other Electrical Equipment".

Starting at 11 o'clock September 18, there will be a special review of the many exhibits featuring an all-inclusive display of latest time saving tools, devices, materials and appliances by Allied Railway Supply Association, Inc.

In addition it has been announced that two men will receive life memberships in the association. They are J. H. Aydelott, vice president (Operations and Maintenance Department), Association of American Railroads, and William T. Faricy, president, Association of American Railroads. They will appear in person at the meetings on Monday, September 17, and Wednesday, September 19, respectively.

Industrial Safety Courses

Evening courses in industrial and

Like radar

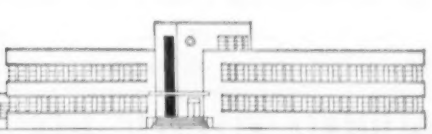
it warns of possible damage to your engine

Vigilant protection . . . 24 hours a day . . . is what PENN Safety Controls give you. At the first hint of excessive water temperature, overheated bearings or oil pressure failure the PENN Control goes into action to prevent damage to your engine!

It will sound an alarm, flash a warning light or stop the engine . . . whichever you choose. This prompt, unfailing action makes it possible to investigate and correct the fault before costly engine damage occurs.

PENN Engine Safety Controls are available in three basic types . . . pressure . . . temperature . . . and combination pressure and temperature. Learn more about this *low-cost protection* for old or new engines. Write for Bulletin E-100. **Penn Electric Switch Co., Goshen, Indiana.** Export Division: 13 E. 40th St., New York 16, N. Y., U.S.A. In Canada: Penn Controls, Ltd., Toronto, Ontario.

PENN



AUTOMATIC CONTROLS

FOR HEATING, REFRIGERATION, AIR CONDITIONING, PUMPS, AIR COMPRESSORS, ENGINES, GAS RANGES

traffic safety are announced by the Center for Safety Education, Division of General Education of New York University, for the fall term beginning September 24th. The expanded curriculum makes it possible for the students selecting a full program of 11 courses to secure either a certificate in industrial safety or a certificate in traffic safety.

The following courses are required: accident prevention, the philosophy and basic principles of accident prevention, industrial hazards, control methods, fire prevention and protection inspection, organization and administration of traffic safety programs, and marine accident prevention.

Weatherhead Distributors

The Weatherhead Company recently announced the appointment of 9 more industrial distributors who will carry complete lines of their various products.

Appointed to handle steel and brass fittings are: B. H. Deacon Co., Inc., Philadelphia; Knox, Inc., East Walpole, Mass.; Spence Tool & Rubber Co., Peoria, Ill.; and P. T. Standard Parts Co., Pontiac, Mich.

Distributor for steel and brass fittings, reusable steel hose ends and industrial hose is Diesel Injection Sales & Service, Norfolk, Va.

The Harry Cornelius Co. will handle the brass fittings, reusable steel hose ends and industrial hose for Albuquerque, N. M.

In Akron and Massillon, Ohio, the Hardware & Supply Co. are the new distributors for industrial tube and pipe fittings.

Reusable steel hose ends and industrial hose will be carried by Hydro Pneumatics, Inc., New York and by Robins Rubber Division of A. K. Robins & Co., Inc., Baltimore.

ASME Fall Meeting

The American Society of Mechanical Engineers will hold its Fall Meeting September 26-28 at the Hotel Radisson, Minneapolis, Minnesota.

In addition to the various sessions there will be plant trips, a luncheon and a reception and banquet. Registration fee for non-members is $3.00.

Cooper-Bessemer Host to Jap Delegates

Eight delegates of the Japanese Diet who will later sit in on the Japanese Peace Conference devoted several days in research at Mount Vernon, Ohio, gathering first hand data on American community life. As part of their study was also to obtain an accurate cross section of a typical American industrial plant. The delegates visited The Cooper-Bessemer Corporation.

New Fluid Hydroformers

A fluid hydroformer, currently being engineered by The M. W. Kellogg Company is expected to be able to convert 55 octane virgin gasolines into 98-175 octane aviation gasoline, it was announced recently.

The plant, a 2000-bbl.-per-day unit, is to be located at the Destrehan, La. refinery of the Pan-Am Southern Corporation. Process design has been completed and construction is scheduled to start within the near future.

The fluid hydroforming process is based on extensive development work

Specify

COLUMBIA

A. C. and D. C.

GENERATORS

• For Coupled Service
• For Belt Drive
• Single or Two Bearing

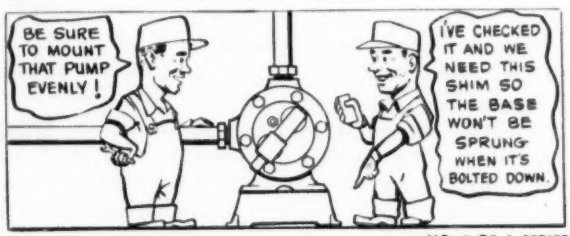
Columbia, with its years of experience, brings to generator set assemblers a wide line of performance proved, sturdily built, A. C. and D. C. Generators.

AC Generators: 6¼ to 1000 KVA
DC Generators and Exciters: 2 to 300 KW

•

Write for information. Our Engineers will be glad to review your requirements.

COLUMBIA ELECTRIC MFG. CO.
4537 Hamilton Ave. Cleveland 14, Ohio



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HOW TO GET THE MOST WORK OUT OF YOUR

VIKING PUMPS

When mounting a Viking Rotary Pump and bolting it down, be sure that the base is not sprung. Bolting the pump down over an uneven surface may cause binding and heating in the stuffing box. It may cause working parts of the pump to bind and wear beyond repair in a short time. The pump must be free enough to turn the shaft by hand.

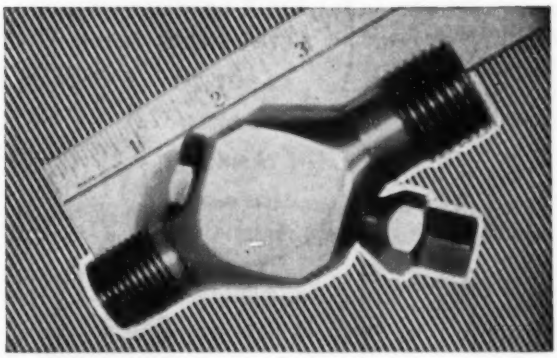
Get EXTRA wear out of your Viking Pumps by giving them EXTRA care. The Viking Service Manual tells you how. It's a handy, illustrated booklet giving you practical help in mounting, operating and maintaining Viking Pumps. Write for your copy of Manual D today. It's FREE.

VIKING AN HONORED NAME IN PUMPING

See Our Catalog in SWEET'S

Viking PUMP COMPANY
Cedar Falls, Iowa

KIENE®
DIESEL INDICATING VALVES

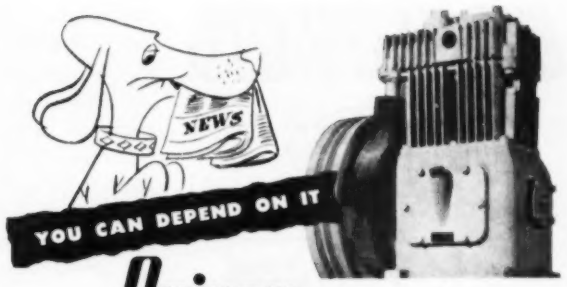


KIENE VALVES are designed to give good service under most severe conditions. WILL NOT BLOW OPEN, as valve opens against pressure. The KIENE VALVE HAS EFFECTIVE GAS SEAL when opened or closed, without use of packing or glands.

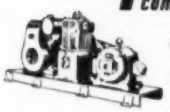
The KIENE VALVE is SMALL AND RUGGED, 4¼" in length and requiring only 3¼" circle of space for attachment. Has been operated at pressures up to 10,000 psi.

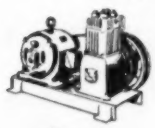
ALL KIENE VALVES have standard indicator plug and wing nut connection. Regularly furnished with male ½" NPT engine connection. Other threads furnished on order. Special adaptions for most Diesel locomotive engines.

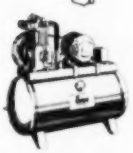
KIENE DIESEL ACCESSORIES, INC.
10352 PACIFIC AVE., FRANKLIN PARK, ILLINOIS



Quincy COMPRESSORS **FOR DEPENDABLE COMPRESSED AIR SUPPLY**







Day in and day out, Quincy Compressors deliver the compressed air supply required. Modern . . . compact . . . rugged in construction, Quincy Compressors are available in wide variety of sizes ranging from 1 to 90 c.f.m. Depend on a Quincy specialist to help you select the type and size compressor to meet your needs. Write Dept. J-20 for details and prices.

ONLY *Quincy* OFFERS ALL THESE FEATURES
- Timken Bearings
- Lynite Rods
- Perfectly Balanced Crankshaft
- Copper-Finned Intercooler
- Automatic and Positive Lubrication

QUINCY COMPRESSOR CO. QUINCY, ILLINOIS
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by Standard Oil Development Company, Standard Oil Company of Indiana and the Kellogg Company. It applies the fluid catalyst principle (finely powdered catalyst supported on vapors and acting as a turbulent fluid) to the reforming of naphthas. This is the same principle which has been widely adopted throughout the world in the catalytic cracking of gas oils to produce high octane gasoline.

Varying operating conditions of the process produce different yields and octane ratings. Under severe operation, the octane rating of the product is 95 CFR-R (clear). Operating for the prime purpose of producing avgas base stocks, the aviation octane ratings reach 98, F-3 and over 175, F-4, with the addition of 4.6 cc. of T. E. L. per gal. In actual refinery practice, through blending of extraneous butanes, the total volume of finished gasoline approximates 100 per cent of the liquid charge volume.

Superior Diesels Installed

Two supercharged 1440-hp. Superior diesels will be installed in the municipal power plant of Newton Falls, Ohio. A similar model was installed in 1948, and plant officials are purchasing the two new diesels to meet system-load increase.

Bowser Buys Laboratories

Bowser, Inc., of Chicago, has acquired owership of National Scientific Laboratories, Inc., of Washington, D. C.

Dr Robert I. Sarabacher, president of National Scientific Laboratories, Inc. has been appointed director of research for Bower, Inc., and will head the product development work of all subsidiary companies. He will remain as president of the former organization, and there will be no changes in laboratory personnel.

Worthington Modernization

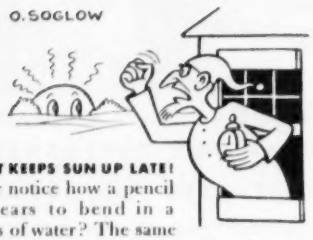
A $500,000 modernization of its Oil City, Pa. plant is planned by Worthington Pump and Machinery Corporation. Plans include re-equipping the present foundry and establishing a new electric power supply.

The plant has retained Sorbo-Mat Process Engineers, foundry specialist of St. Louis, to make foundry layouts and develop a method of making castings, known as "innoculation"; a process that produces various irons of predetermined physical and chemical properties.

New molding machines, sand conditioning sand supply equipment will be installed in the plant. Mechanization includes installation of overhead crane service at all working stations and 500-ft. of roller conveyors. New mold drying ovens will be installed and melting capacity will be increased by installing one new cupola and reconditioning the present one. A mechanical cupola charging system will be provided to automatically feed coke and all raw scrap and pig materials to both cupolas.

Modern metal pouring ladles will assure protection of workmen, and automatic shakeout stations complete with the necessary separators and screens will free the castings from the sand which will then be returned to the system in specially made conveyor

AIR-MAZING FACTS



DUST KEEPS SUN UP LATE! Ever notice how a pencil appears to bend in a glass of water? The same thing happens to light passing through the earth's dusty atmosphere. As a result you can still see the sun after it's below the horizon.

COUNTER ATTACK! Dust falling on counter displays can cost stores thousands of dollars in shopworn merchandise. Leading stores stop dust, dirt and even smoke with Electromaze® electrostatic air filters. File-drawer construction makes installation and servicing easy.

BAD AIR GETS FRESH START! Air-Maze panel filters keep damaging dust and grit out of engine rooms, diesel locomotive cabs, offices, etc. They're all-metal, cleanable, have high dirt-holding capacity and low pressure drop. Available in a wide variety of types and sizes.

WHETHER YOU BUILD OR USE engines, compressors, air-conditioning and ventilating equipment, *or any device using air or liquids* — the chances are there is an Air-Maze filter *engineered* to serve you better. Representatives in all principal cities, or write Air-Maze Corporation, Cleveland 5, Ohio.

AIR-MAZE

The Filter Engineers

AIR FILTERS
SILENCERS
SPARK ARRESTERS
LIQUID FILTERS
OIL SEPARATORS
GREASE FILTERS

belts. Safety exhaust systems will be provided throughout the foundry, and dust arresting installations will remove all hazards at points where sand is conveyed or transferred.

To supply the increased power for these installations a contract has been signed with the Pennsylvania Electric Company for the purchase of all electric power requirements.

While the Oil City plant is being used for the miscellaneous overflow from the corporation's other factories, production of some products is being transferred to this plant for total manufacture.

New Thor Branch Headquarters

Independent Pneumatic Tool Company, manufacturer of Thor portable power tools, has transferred its Cincinnati branch to a new, modern building at 3726-28 Floral Avenue.

The new headquarters offers factory branch service facilities, including trained service mechanics, a complete stock of replacement parts and accessories. Adjacent to the service center are quarters housing the branch sales and customer service staffs.

New Mack Plant

Mack Trucks, Inc. recently announced the beginning of construction of a new service parts plant in Bridgewater, N. J. It will lie between the corporation's major manufacturing plants at Plainfield, N. J. and Allentown, Pa.

Upon completion of the new plant, the building now being used for service supply at Plainfield will become available for the production of vehicle engines and transmissions, thus providing approximately 300,000 sq. ft. of space for expansion of the manufacturing plant.

The new service parts building and offices will occupy approximately 425,000 sq. ft. It is expected that it will be operating by January 1, 1952.

Griscom-Russell Moves Offices

The Griscom-Russell Company recently moved its general offices from New York City to Massillon, Ohio, where the company's plant for manufacturing heat transfer apparatus is located. The move was made to cen-

WHAT'S THE BEST WAY TO STRIP PAINT FROM METAL PARTS TOO LARGE TO BE SOAKED IN TANKS?

See Page 3

Oakite's New FREE Booklet on Paint Stripping

answers many questions that will lead you to better stripping procedures. You'll want to read more about:

What's the best way to strip large areas of structural metal where a steam supply is available? ***See page 5.***

What is the best method when steam is not available? *See page 7.*

What is the cheapest way to strip metal parts in large volume? ***See page 9.***

What are the best ways to prepare stripped surfaces for repainting? *See page 11.*

What strippers are best for removing oil-base paints? . . . Synthetic enamels, alkali-resistant plastics or resin-based paints? . . . Japans, wrinkle finishes, nitrocellulose lacquers, alkyds, phenolics and ureas? ***See page 12.***

FREE For a copy of "How to STRIP PAINT" write to Oakite Products, Inc., 23A Thames St., New York 6, N. Y.

SPECIALIZED INDUSTRIAL CLEANING

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MATERIALS • METHODS • SERVICE

Technical Service Representatives Located in Principal Cities of United States and Canada

tralize the administration, general sales, engineering, development and other departments.

To accommodate the various departments, a new office building is being erected on the grounds of the plant opposite the Massillon station of the main line of the Pennsylvania Railroad. The plant has sidings on three railroads, and is served by numerous trucking lines.

The New York office will continue to operate as one of the sales offices.

New Chain Belt Warehouse

A new 100- by 111-ft. warehouse providing expanded facilities for servicing the Pacific Northwest is now being constructed for Chain Belt Company in Portland. The company has had a Portland warehouse for about 28 years.

Besides housing increased stocks of chain, sprockets, power transmission equipment, take-ups, elevator buckets, belt conveyor idlers, and spray nozzles, the new building will also contain the company's Portland district sales office. A railroad spur to the loading platform, truck loading and unloading facilities and ample car parking space will facilitate better customer service.

New Mid-Valley Construction

Mid-Valley Pipeline Company recently announced that it has completed negotiations with eight contractors for the construction of six new booster stations, the installation of additional units at present pumping stations and the construction of a third crossing of the Mississippi River for its 1000-mile crude oil line from East Texas to Lima, Ohio.

Construction of the new booster pump stations, additional pumping units, additional tankage and microwave relay system stations will cost between 8 and 9 million dollars. Completion is expected early in 1952, provided satisfactory delivery can be obtained on materials on order.

The new construction will increase from 155,000 bbls., to 235,000 bbls. per day the capacity of the 565-mile section of 22-in. line between Mayersville, Miss., and Hebron, Ky., with proportional increases in the sections from Longview to Mayersville and from Hebron to Lima, Ohio.

New De Laval Building

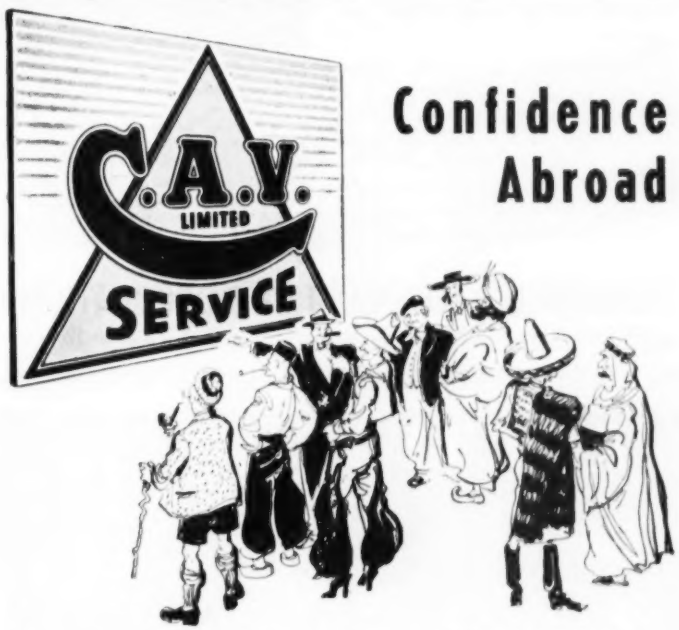
The De Laval Steam Turbine Company has recently announced the completion of a new building in San Francisco. It will be the San Francisco headquarters for sales and service activities. Besides providing increased warehousing facilities for standard centrifugal pumps, IMO pumps, speed reducers and flexible couplings, it will also permit faster handling of repair and service orders.

This expanded activity will be under the direction of C. F. Reeves, formerly in charge of West Coast sales.

DEMA Educational Conferences

A series of one-day educational conferences for the coming fall has been announced by the Diesel Engine Manufacturers Association.

The conferences have been set up

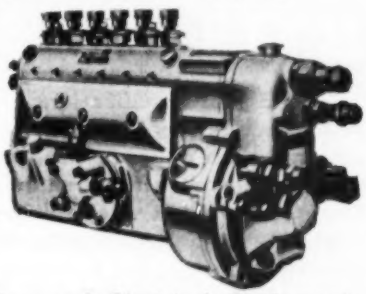


Confidence Abroad

Transport operators all over the world have learnt to trust this sign.

In any language the letters on the C.A.V. sign stand for first-rate service facilities, maintained by highly-trained craftsmen, using special precision equipment.

Wherever vehicles fitted with C.A.V. Fuel Injection Equipment are exported — whether to Trondheim, Santiago, Hong-Kong or Sydney—there's a service agent or depot to give it the specialist attention needed for such high-precision equipment.



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Fuel Injection and Electrical Equipment

Service Depots throughout the World

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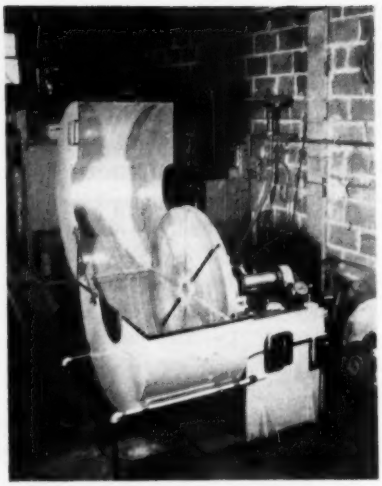
CENTRIFUGAL REBABBITTING

WHEN the job of re-metaling bearings comes up on your maintenance schedule call Sigurd Golten, who will rebabbitt your diesel engine bearings in a fraction of the time usually required.

Through the use of specialized centrifugal rebabbitting apparatus, the Sigurd Golten Machine Corporation can return bearings to service quickly and in "good as new" condition.

Unsolicited testimonials report that bearings rebabbitted by the Golten method outlast by far the usual work of this kind. Our equipment is engineered to handle bearings of all diameters from lightweight high-speed diesels to large slow speed direct drive diesels.



Shown above is part of our specialized rebabbitting machinery in regular operation. The centrifugal table is in vertical, or operating position. During the cast, the safety cover is dropped over the spinning table. Carefully engineered equipment and highly skilled operating personnel assure perfect rebabbitting by the centrifugal method.

SIGURD GOLTEN MACHINE CORPORATION

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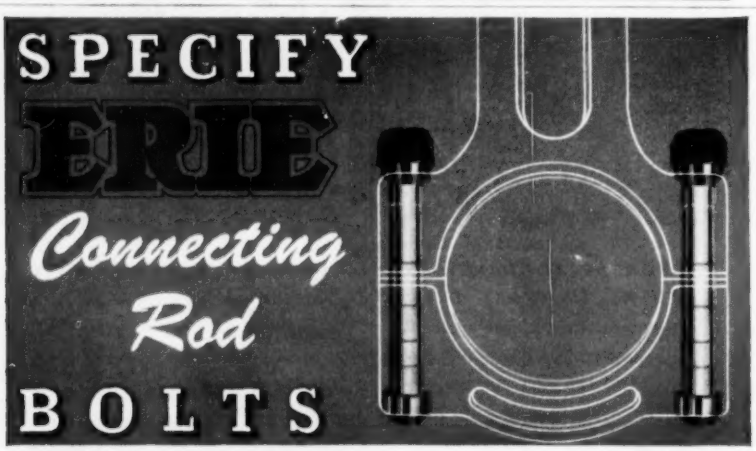

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REPRESENTATION IN PRINCIPAL CITIES

across the country from New England to the Pacific Coast and professors who teach courses in the diesel field will be invited to attend.

The program will be a combination of plant tours and discussions on selected technical subjects, with the object in mind of giving these educators who attend material that will aid them in doing a better job of teaching.

Conferences and the time they are to be held are as follows:

Buffalo, N. Y., October 9, at the Worthington Pump and Machinery Corp.

Cleveland, Ohio, October 16, at the Aluminum Company of America.

Chicago, Ill., October 30. DEMA will hold a breakfast for those professors attending the diesel sessions of the Society of Automotive Engineers.

Denver, Colorado, November 3, at the University of Denver.

Oakland, California, November 6, at the Winslow Engineering Company.

Philadelphia, Pa. November 8, at Wilkening Manufacturing Company.

Los Angeles, California, November 8 at Farr Company, Inc.

Meriden, Conn., November 13 at The Cuno Engineering Corporation.

Organizational News

Hunt-Spiller Promotes

Hunt-Spiller Manufacturing Corp. has advanced Frederick L. Murray, iron and steel molding foreman since 1943, to assistant superintendent of foundries. He succeeds William E. Mulcahy, recently named superintendent of foundries.

Minneapolis-Honeywell Sales Engineers

Minneapolis - Honeywell Regulator Company has added 33 new sales engineers to its force. The entire group recently completed a course in industrial instrument maintenance and repair, held at the Brown Division school in Philadelphia. The men and cities to which they were assigned are:

Albert F. Sommer, New York; John E. Tutty, East Orange, N. J.; James

V. Collins and Robert F. Trump, Boston; Walter J. Loughran, Providence; George S. Raab, Hartford; John M. Caylor and George A. Stiftinger, Philadelphia; David Y. Drummond, Wilmington; Roy W. Freeman, Atlanta; Charles O. McAtee, Jacksonville; James T. Emerson, Greenville; Robert D. Clarke, Mobile; Donald P. Moreland, Cleveland; Joseph A. Hamblin, Columbus; John E. Flaherty, Dayton; Jack W. Larsen, Wilton A. Bass and Vendel W. Immel, Detroit; Thomas H. Jenkins, William H. Johnson and John L. Matter, Chicago; Paul K. Webster, Indianapolis, and Philip A. Parker, St. Louis; Malcolm L. Johnson, Twin City; Warren G. Hardy, Carl T. Stevens and Herman R. Hampton, Houston; Bernard J. Alberts and Julius H. Matherne, New Orleans; George W. Leggett, Tulsa; and Frank G. Fischer and Michael J. Joncich, Los Angeles.

G-E Appointments

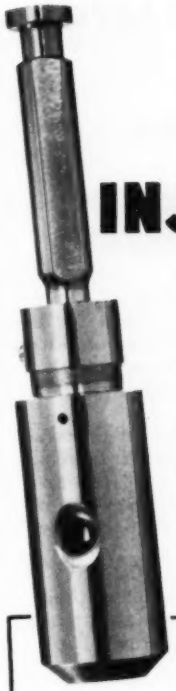
Arthur R. Hines has been appointed assistant manager of marketing for the General Electric Company, it was announced recently. He will be located at the New York office.

A native of St. Louis, and a 1921 graduate of Syracuse University, Mr. Hines joined the company as a student engineer on the test course in Schenectady. Since then he served in various capacities, and has been manager of the Michigan sales district of the apparatus lines since its formation in 1949.

Dr. Malcolm H. Hebb has been appointed assistant manager of the General Physics Divisions of the Research Laboratory. Three divisions are included in the group—weather research, light-producing methods, and semiconductors.

Dr. Hebb has been an instructor in physics at Duke University, and a research associate in the Underwater Sound Laboratory at Harvard. He was a research physicist for Sharples Corporation and in 1949 joined the G-E research laboratory.

C. W. Bryant is the new manager of the purchasing section of the materials and purchasing department. He joined the company in 1931 upon graduation from Carnegie Institute of



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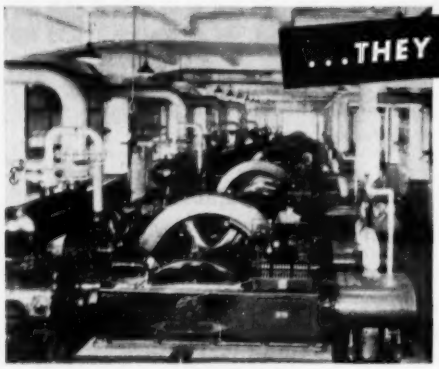
LEADING PUMPS AND COMPRESSORS HAVE

Manzel FORCE FEED LUBRICATORS



...THEY NEVER FORGET

Worthington Compressors in an automobile plant, with Manzel Model 94 Lubricators

- Manzel lubricators supply each wearing point with exactly the amount of oil it needs, and *no more.* Thus they reduce oil consumption as much as 90%.

"Manzels" are furnished as standard equipment on leading makes of engines and machinery. Or they can be installed on your present equipment.

We will gladly have a Manzel lubricator engineer submit recommendations without obligation.

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Why it Pays to Select Manzel Lubricators

- THEY LENGTHEN THE LIFE OF MACHINERY
- THEY ARE AUTOMATIC AND TROUBLE-FREE
- THEY ELIMINATE "DOWN TIME"
- THEY CORRECTLY LUBRICATE EACH POINT

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NATIONAL METAL & STEEL CORP.
Dept 26, Terminal Island (Los Angeles Harbor), Calif.
TELEPHONE—LOS ANGELES: NEVADA 6-2517

Technology as a student engineer on the test course. Subsequent assignments in the Schenectady Works included cost reduction work, inventory control supervisor, assistant to production manager, purchasing manager, purchasing agent, and assistant production manager, apparatus department. In 1949, he joined the former purchasing department as ferrous products purchasing agent.

Hunt-Spiller Appointments

Harry Oldham has been named consultant for the ferrous and non-ferrous foundries of Hunt-Spiller Manufacturing Corporation. Succeeding him as superintendent of foundries is William E. Mulcahy.

Richard P. Carroll has been named production control manager. He remains in charge of cost and materials controls.

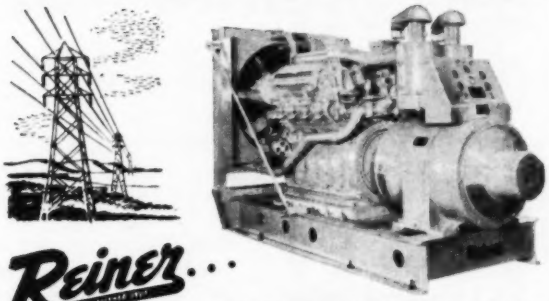
New G. M. Treasurer

The board of directors of General Motors at a recent meeting elected George Russell treasurer of the corporation, with headquarters in Detroit. He succeeds Meyer L. Prentis, who has retired after 40 years of service.

Mr. Russell, who has been serving as finance manager of the Overseas Operations Division, was graduated from the University of Minnesota in 1927 and later that year joined the corporation as a member of the financial analysis staff of the treasurer's New York office. He was appointed assistant treasurer of the corporation in 1944, and in 1949 was named finance manager of the Overseas Operations Division, with supervision over the financial activities of all the operating subsidiaries located outside the U. S. and Canada.

Mr. Prentis joined the Corporation in 1911 as chief accountant and auditor. Five years later he was named comptroller and in 1919 was elected treasurer. He has served continuously since 1929 on the board of regents of the G. M. Institute and is a director of a number of subsidiaries in the U. S. and Canada, including General Motors Acceptance Corporation and Yellow Manufacturing Acceptance Corporation. These responsibilities also will be assumed by Mr. Russell.

KNOWN THE WORLD OVER!



Reiner...

DIESEL GENERATORS

Shown above, for example, is one of a pair of 100KW 2400 volt Reiner generators installed in a South American power plant. Everywhere in the world you'll find similar installations, because Reiner auxiliary equipment is known for its efficient, economical, troublefree service.

Reiner generators come in a complete selection of sizes and capacities ranging from 5 to 750 volts for D.C. or 50 or 60 cycle A.C. current.

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FREE BULLETINS on standard units sent on request. Write today, stating your requirements.

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ROPER ROTARY PUMPS

The Name of Dependability

Widely Used in Diversified Industries

Whether your equipment is dependent upon a pump for fuel transfer, coolant work, or hydraulic action, you will maintain greater operating efficiency with the rugged Roper — Series F. This series is built to pump clean liquids of all kinds, and is available in standard or special-built designs in 1 to 300 g.p.m. . . . pressures to 300 p.s.i. WRITE TODAY for Catalog and Complete Information.

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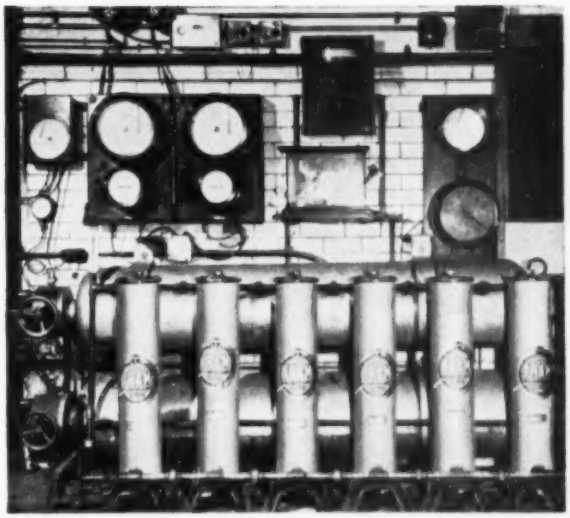

These six Fram Filters serve 840 h. p. Fried Krupp Diesel at large eastern university. This Diesel drives a 600 kw. Crocker-Wheeler generator.

University Cuts Maintenance Costs of Diesel Power Plant with FRAM Filters

Four Fram Filter installations filter dirt, grime, sludge and carbon from lubricating oil of 545 h.p., 630 h.p., 840 h.p. Fried Krupps and a 448 h.p. Baldwin in power house of large eastern university. Engineers consider Fram Filters the best . . . definitely a money-saver. Absolutely no maintenance except changing cartridges.

FRAM Filcron Filters Do the Job Better!

- *Remove solid and abrasive contaminants 1 micron (.000039") and larger*
- *Minimize Engine Wear*
- *Reduce Engine "Down-time"*
- *Extend Engine Life*
- *Lower Operating Costs*

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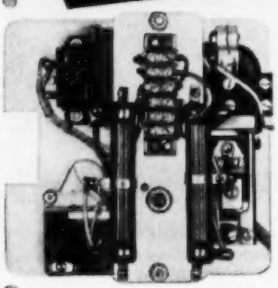

Interior view of Type SR-SF

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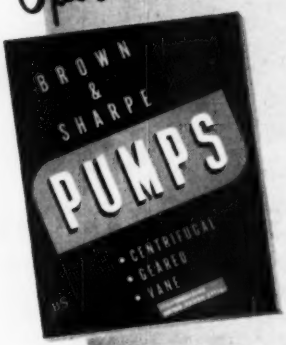

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Quincy Transfer

Harold Stone has been appointed manager recently of the St. Louis office and sales territory for Quincy Compressor Company.

Mr. Stone was transferred from the company's New York office. Before that he was a member of the staff at the office and factory in Quincy, Illinois.

Allis-Chalmers Appointment

H. Stanley Bimpson has recently been named to the office of the director of engineering of Allis-Chalmers general machinery division as consulting engineer.

Bimpson, a mechanical engineering graduate of the University of Virginia, has been with the company since 1920. During this time he has served in various capacities in the engine and condenser and blower departments. Since 1947, he had been chief engineer of the blower and condenser department.

Worthington Sales Manager

V. de P. Gerbereux has been appointed recently as manager of the Centrifugal Pump Sales Division of Worthington Pump and Machinery Corporation. He succeeds A. H. Borchardt, who was recently elected vice president in charge of centrifugal, reciprocating and vertical turbine pump sales.

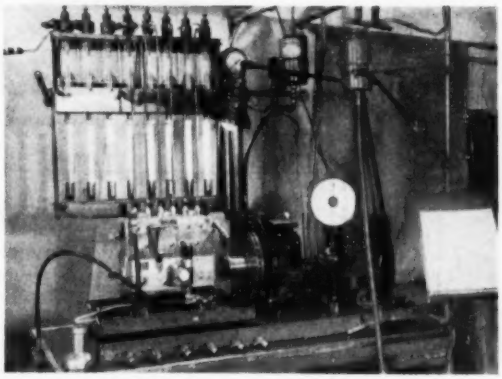
Mr. Gerbereux was graduated from Cornell University with a mechanical engineering degree in 1924 and the same year took the company's student training course. He became successively a centrifugal pump designer, an application engineer and in 1934 assistant manager of the Centrifugal Pump Sales Division. Inventor of a specific speed slide rule and an acid valve, he is also known as the author of the centrifugal pump section of Kents Handbook.

Canadian Pacific Diesel Inspector

S. A. Jones has been named to the new position of district inspector of diesel equipment for the Canadian Pacific Railway at Calgary. Twenty-seven years with the road, he has been diesel and gas car maintainer at Winnipeg for the past six years. At Calgary he will be the center of the newest dieselization program with 28 units of this power to be delivered there this year to make a start on the switch from steam to diesel locomotives in the freight service between Calgary and Revelstoke.

Mr. Jones started in 1924 as an electrician apprentice at Weston Shops, Winnipeg. All of his service until now has been at Weston where as a journeyman he worked all branches of the trade.

DIESEL INJECTION SERVICE



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Cleaver-Brooks Appointment

F. A. Hopp, formerly associated with the Delta Power Division of Rockwell Manufacturing Company, has been appointed advertising manager of the Cleaver-Brooks Company

Hopp spent 11 years with Delta in Milwaukee, serving as assistant advertising manager and director of publicity. A native of Whitefish Bay, he attended the University of Wisconsin and Marquette. He is a member of the Milwaukee Industrial Marketing Association.

Link-Belt Speeder Elects

Link-Belt Speeder Corporation, shovel-crane manufacturer, announced

recently that Kenneth T. Rudd has been elected treasurer, with headquarters in Cedar Rapids. He succeeds Harry E. Kellogg, who retains his post of vice president and treasurer of Link-Belt Company in Chicago.

Mr. Rudd, a graduate of Indiana University, joined the company in the Ewart plant accounting department at Indianapolis. He later served as plant accountant at Atlanta, Ga. and the Caldwell plant in Chicago, and has for the last two years been assistant controller at the executive offices in Chicago.

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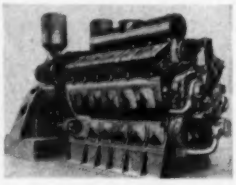

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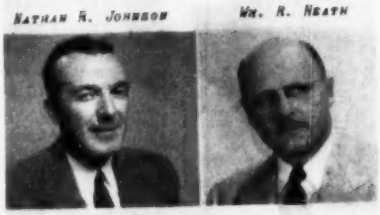
Buffalo Forge Promotions

Nathan R. Johnson, director and factory manager of Buffalo Forge Company, is retiring after nearly 35 years of service. A graduate of the University of Wisconsin, he joined the company as purchasing agent in 1917, moving up to his present position in 1945.

NATHAN R. JOHNSON — WM. R. HEATH



JOHN E. GILL — GEO. P. SCHIVLEY

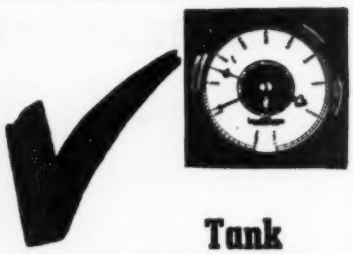
Taking Mr. Johnson's place is William R. Heath. A graduate of Cornell, he joined the company in 1922, became assistant chief engineer in 1924 and in 1948 became chief engineer. His new title will be manufacturing director.

Taking Mr. Heath's place as chief engineer is John E. Gill. Starting in the engineering department in 1929, he was transferred to sales in 1930, and has been in charge of pressure blower and axial flow fan sales for a number of years.

George P. Schivley is promoted to plant manager. He was formerly plant superintendent. Before joining the company in 1940 as manufacturing engineer, he was with the Cleveland Worm Gear Co. and the DeLaval Steam Turbine Co.

Leeds & Northrup Changes

Appointment of Dr. Raymond C. Machler as director of research and a member of the executive committee of Leeds & Northrup Company, manufacturers of electrical measuring instruments, automatic controls, and heat-treating furnaces, has been announced recently. He succeeds I. Melville Stein, who recently was elected



Tank Contents At A Glance

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UEI graduates are energetic, willing workers. They have good basic training in operation, maintenance and repair of all types of Diesel engines. The Diesel man you want is ready to go to work for you in the U.S. or Canada, or will travel farther if the opportunity is right. Tell us your needs.

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to the newly created post of executive vice president.

Dr. Machler is a graduate of Northwestern University, where he received the B.A., M.A., and Ph.D. degrees. He joined the company in 1929 as a research engineer and physicist and became associate director of research in 1948. He is known for his contributions to the fields of optical and pyrometric measurement.

G. A. Perley and A. J. Williams, Jr., both formerly assistants to the director of the Research Department, were made associate directors of research.

Bowser Resignation

E. C. March, president of the Fort Wayne Division of Bowser, Inc., announced his resignation recently, after 42½ years of service with the company. J. P. Orchard was elected to succeed him as president. Mr. Marsh has been actively connected with the company since 1909 and will continue to serve as a member of the board of directors.

Mr. Orchard joined the company at Fort Wayne in 1940 as controller, becoming treasurer and later executive vice president of the Fort Wayne Division. Formerly, he was engaged as management consultant in various types of manufacturing and distributing enterprises in the industrial field.

American Brake Shoe Addition

Robert S. Bubb has joined American Brake Shoe Company as market-

ing engineer. He will study the distribution methods of the company's ten operating divisions in their effort to further diversify their markets and improve customer service.

Mr. Bubb has been engaged in a wide range of sales, marketing and management engineering activities since graduating from Yale University in 1932. Before joining the company, he was a management engineer with Robert Heller & Associates.

Analyzing Maintenance Records

(Continued from page 53)

provements in the rings themselves, design of the interrelated engine components, or other design factors would help.

On the other hand, it is entirely possible that the most significant improvement could be achieved by better operating and maintenance practices. Greater attention to the major causes of ring and cylinder wear, contaminated air or oil, might help considerably. Then there are the matters of proper and adequate lubrication, correct engine timing, and satisfactory fuel injection to be considered, all of which could be contributory factors. Lastly, don't forget proper installational procedures.

These are just a few of the ideas that crop up from a study of only one phase of the "Cost Report". A careful analysis of the whole will more than pay for the time involved.

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Complete line available from ½" pipe size to 6" pipe size

Automatic temperature control for jacket water or lube oil for engines and compressors from 5 hp to 5000 hp.

"Amot" thermostats will give your engines many years of dependable operation without any servicing or adjusting. Very reliable under conditions of extreme vibration.

Used for automatic temperature control on pipe line engines, electric power plants, marine engines, drag lines, and on all other engine applications.

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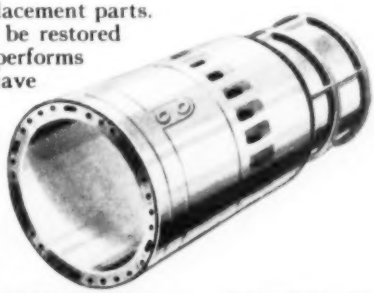
And it is never hard to "bust". For covered wagon stragglers, the redskins lay in wait. Now, it's competition that liquidates the inefficient.

Like pioneers who led the way, many Diesel owners *already* have the full competitive advantage that comes from using PORUS-KROME* and VANDERLOY M.

They no longer have the expense of stocking odd-size parts. Instead, their cylinders and crankshafts, no matter how badly worn, are brought back to original dimensions — *just as yours can be.*

No need, *then*, to worry about where to get new replacement parts. For less cost, *all* cylinders and crankshafts can be restored repeatedly. And PORUS-KROME wears much longer, performs more efficiently — so much so that it pays to have original equipment processed with it.



That's standard practice, now, with many Diesel owners. Competitively, they're headed for "Pike's Peak"—and with very little chance to "bust".

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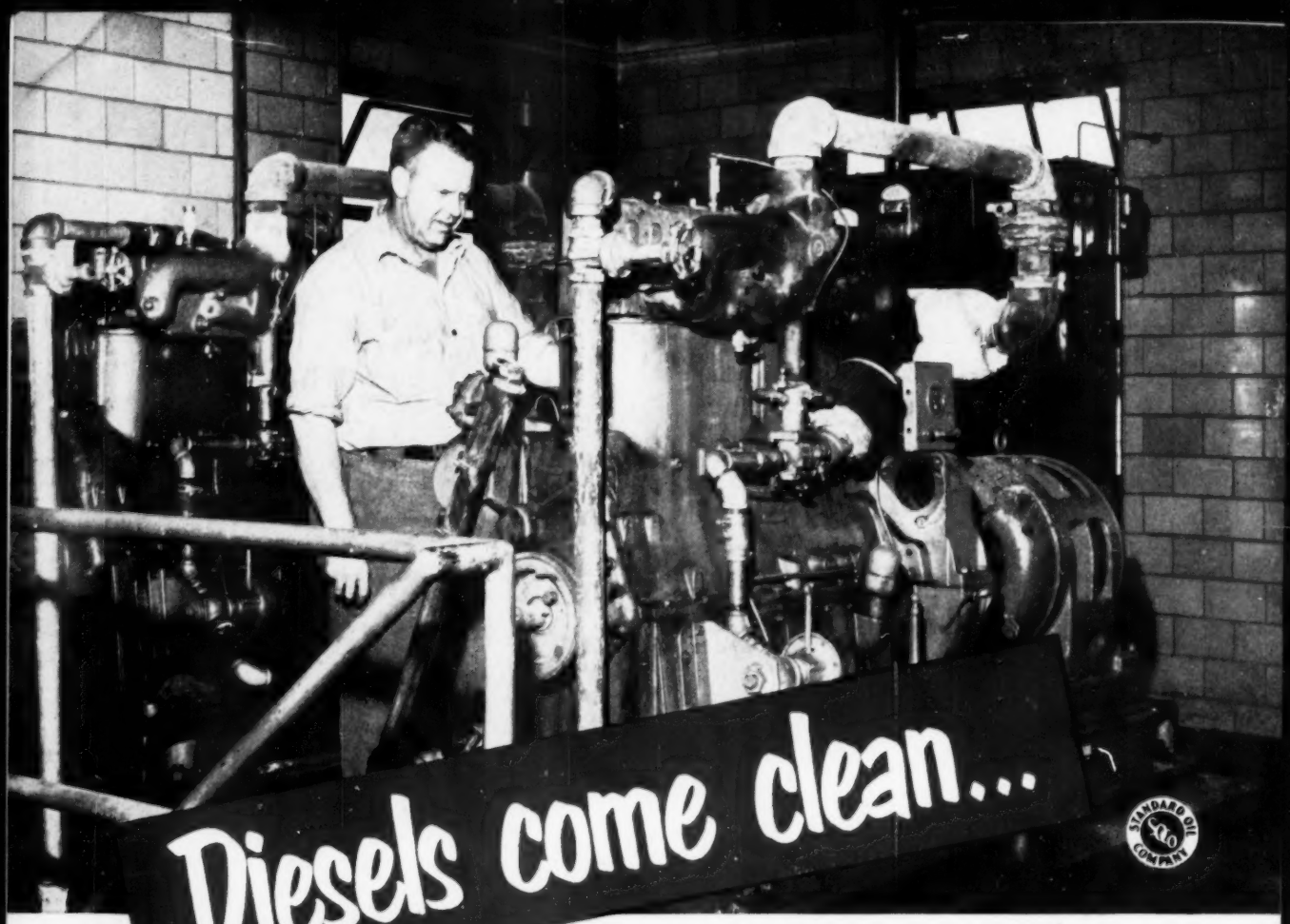

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